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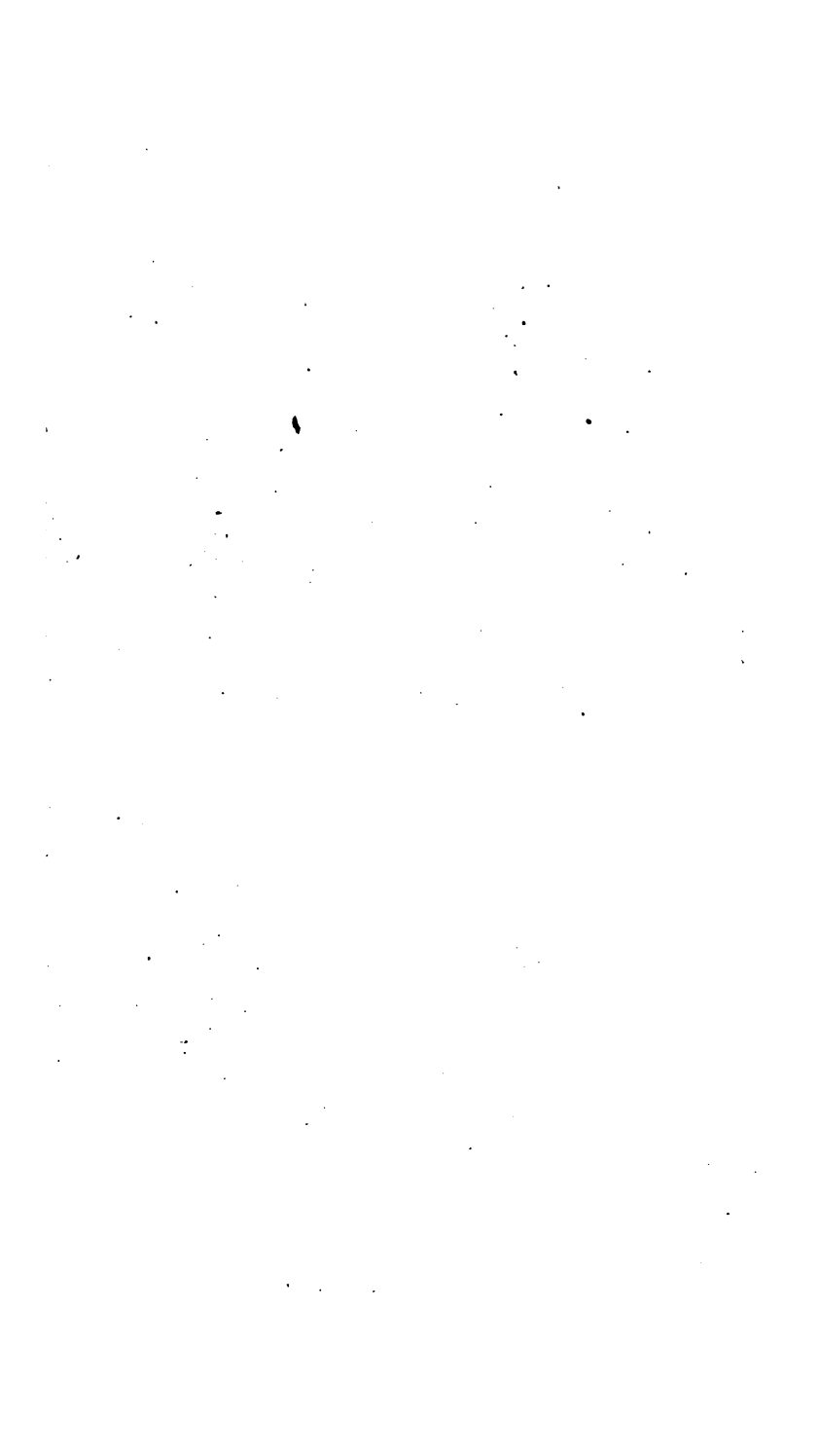
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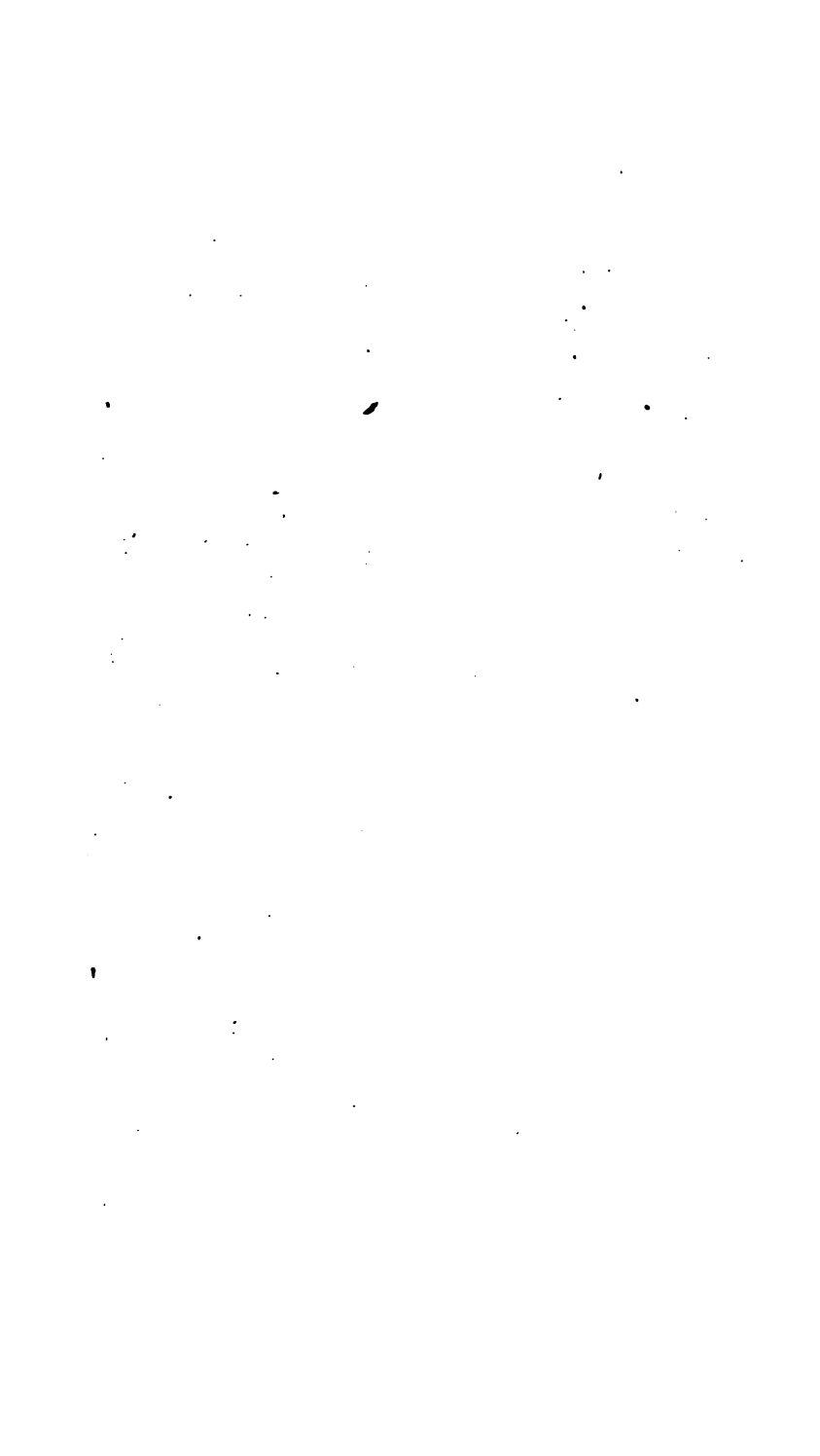
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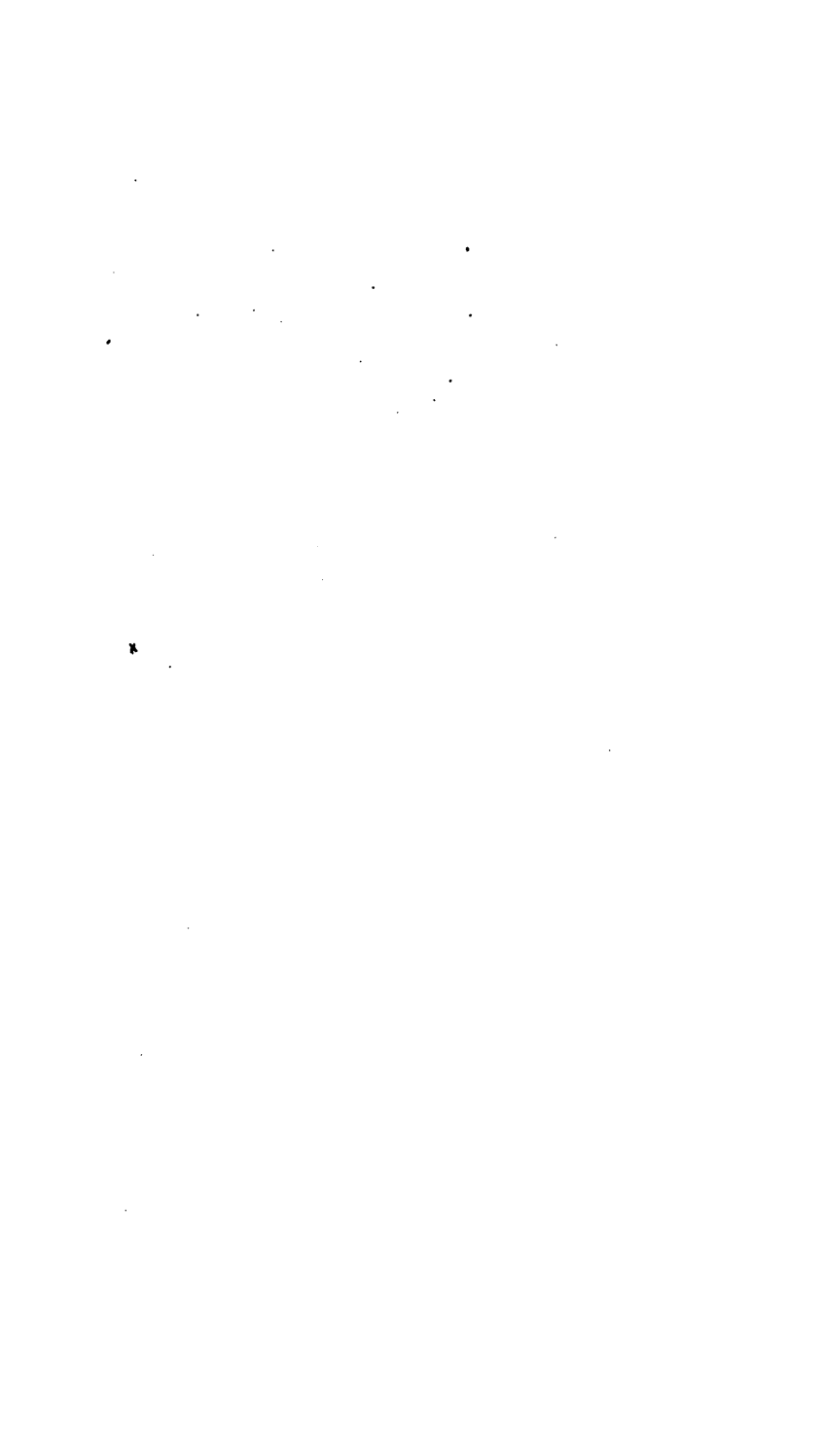






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PREFACE.

It was not without considerable hesitation that I determined to make an effort to supply a want which, from personal experience I considered was urgent, and which did not appear likely to be soon supplied.

The origin of this work was a desire to supply officers and non-commissioned officers studying at the School of Musketry with a book which might aid them in obtaining certificates.

I have taken my questions consecutively through every paragraph of the Text Books, carefully avoiding 'catch questions,' my object being to provide officers and non-commissioned officers with a number of questions on the subjects of examination by which they might, after careful study of the Text Books, be able to test their proficiency in those subjects.

The amount of work to be got through in the two months allowed for the Course is considerable, I would therefore caution officers against supposing that they can by hard work during the latter part of the Course make up for time that may have been lost at the commencement. Steady application throughout the Course is the surest way to bring the same to a successful issue.

I would say a word with reference to the lectures and catechisms by the Chief and Captain-Instructors ; more is to be learnt by paying attention to these lectures and catechisms than by double the time devoted to the subjects out of hours.

It is undoubtedly most important to make sure of a first-class certificate, but, at the same time, I maintain that a first-class extra certificate is within the reach of all who choose to make an effort to obtain it.

Many officers throw up the extra subject before they really understand what is required in order to obtain a first-class extra certificate ; this is chiefly owing to the commencement of the Text Book on the 'extra' or voluntary subject being perhaps a little confusing to those who have no talent for mathematics. I would advise a careful perusal of the whole work before the idea of 'an extra' is abandoned.

In working up the subjects of examination, officers and non-commissioned officers should remember that extra proficiency in any one subject will not compensate for deficiency in others, and that, therefore, it is most important to acquire a thorough knowledge of the whole.

I considered it unnecessary to insert questions on Sec. 2, Part IV., Preliminary Drill, as the time which it is necessary to bestow on the four Lectures is sufficient of itself to engrave them indelibly on the minds of all. I have therefore, in lieu of the questions, inserted the four Lectures, with notes and figures.

If, by means of the following pages, I have in any way aided officers and non-commissioned officers in obtaining Hythe certificates, I shall feel that the time devoted to the work has not been entirely thrown away ; if, on the other hand, I shall be deemed to have failed in simplifying and facilitating the student's path, I have failed in the sole object of my undertaking.

September 8, 1878.

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HYTHE CERTIFICATES.

THEORETICAL PRINCIPLES.

Q. 1.—What is ‘matter’?

A.—The substance of which bodies are composed.

Q. 2.—How many kinds of matter are there, and what terms are applied to them?

A.—There are four kinds: 1st, solid; 2nd, liquid; 3rd, æriform; 4th, imponderable, or destitute of weight.

Q. 3.—What do you mean by the term ‘body’?

A.—Any definite portion of matter, of which the existence can be perceived by our senses, or which may act or be acted upon by other bodies.

Q. 4.—What is a ‘particle’?

A.—An atom so minute as to admit of no division.

Q. 5.—What do you understand by the term ‘mass’?

A.—The quantity of matter in any body.

Q. 6.—To what is ‘mass’ proportional, and why?

A.—To the weight, whether the bulk be great or small, for the weight is equal to the mass multiplied by the force of gravity.

Q. 7.—What is ‘cohesion’?

A.—The force which holds together the particles of a body.

Q. 8.—How does it act?

A.—Only between particles of the same kind and at insensible distances.

Q. 9.—In what form would all substances be without cohesion?

A.—Small dust.

Q. 10.—What do you understand by the terms 'volume' and 'bulk'?

A.—The space a body occupies.

Q. 11.—What is 'figure'?

A.—The form or shape of a body.

Q. 12.—What does the term 'density' mean as applied to bodies?

A.—The quantity of matter actually in those bodies.

Q. 13.—Define 'elasticity.'

A.—An inherent property in bodies, by which they partially recover their former figure or state, after the removal of external pressure.

Q. 14.—Does perfect elasticity or non-elasticity exist?

A.—No.

Q. 15.—What is the term 'inertia' used to denote?

A.—The resistance of a body at rest to being put in motion, or, if in motion, to any change of direction.

Q. 16.—On what does this resistance depend?

A.—On the nature of the motion, or the obstacles to be overcome.

Q. 17.—What is 'motion'?

A.—The passing of a body from one place to another.

Q. 18.—What is 'velocity'?

A.—The rate at which a body travels, or moves over a certain space in a certain time.

Q. 19.—When is the velocity of a body said to be 'uniform'?

A.—When it passes through equal spaces in equal times.

Q. 20.—When 'variable'?

A.—When through unequal spaces in equal times.

Q. 21.—When 'accelerated'?

A.—When through greater spaces in each equal successive portion of time.

Q. 22.—When 'retarded'?

A.—When through less spaces in each equal successive portion of time.

Q. 23.—What is 'initial velocity'?

A.—The velocity of the projectile at the instant it leaves the muzzle.

Q. 24.—What is the initial velocity of the bullet fired from the Martini-Henry rifle?

A.—1325 feet per second.

Q. 25.—What do you understand by the term 'final velocity'?

A.—The velocity of the projectile at the end of any given range.

Q. 26.—What is 'terminal velocity'?

A.—The velocity attained by falling bodies.

Q. 27.—Why cannot falling bodies exceed a certain velocity?

A.—On account of the resistance of the air becoming equal to the force of gravity.

Q. 28.—What is the terminal velocity of a spherical musket ball?

A.—213 feet per second.

Q. 29.—What is 'relative velocity'?

A.—The velocity of one body as compared with that of another.

Q. 30.—On what does the velocity of rotation depend?

A.—The initial velocity, and the inclination of the grooves.

Q. 31.—How do you find the 'initial velocity of rotation'?

A.—By dividing the initial velocity in feet by the number of feet in which one complete turn is made by the bullet.

Q. 32.—What is the 'velocity of rotation' of the bullet fired from the Martini-Henry barrel?

A.—724 revolutions per second.

Q. 33.—If two rifles be fired whose spirality is different, which of them, both having the same initial velocity of rotation, will have the lowest initial velocity?

A.—The rifle with the greatest spiral will have the lowest initial velocity.

Q. 34.—What is the ‘centre of rotation’ of a body?

A.—The point or line about which a body revolves.

Q. 35.—What is ‘momentum’?

A.—The quantity of motion in any moving body.

Q. 36.—What is the momentum always equal to?

A.—To the mass multiplied by the velocity or $M V$.

Q. 37.—What will be the comparative momenta of bodies of different weights, but moving with the same velocity?

A.—It will be in proportion to the products of their weights and velocities.

Q. 38.—When are the momenta of bodies said to be equal?

A.—When their velocities are inversely as their quantities of matter.

Q. 39.—How many ‘laws of motion’ are there?

A.—Three.

Q. 40.—What are they?

A.—(1) Every body continues in a state of rest or of uniform motion in a straight line until a change is effected in it by the agency of some external pressure.

(2) When any force acts upon a body in motion, the change of motion which it produces is in the direction and in proportion to the magnitude of that force.

(3) Action must always be equal and contrary to reaction, so that in the case of one body impinging upon another, whatever momentum is lost by the one is gained by the other, the sum of their momenta remaining unaltered.

Q. 41.—What is ‘force’?

A.—A power which moves or stops, or tends to move or stop, a body.

Q. 42.—How is force measured?

A.—By weight; thus forces which will bend a spring into the same position as weights of 4, 5, and 6 lbs., are said to be forces of 4, 5, and 6 lbs. respectively.

Q. 43.—What is meant by the direction of a force?

A.—The line in which it tends to produce motion.

Q. 44.—What is 'friction.'

A.—The resistance offered to a body by the surface over which it passes.

Q. 45.—What sort of a force is friction?

A.—A retarding force.

Q. 46.—Define 'gravitation.'

A.—A law by which all bodies or particles of matter are 'attracted' towards one another.

Q. 47.—What is terrestrial gravitation?

A.—A law of nature by which all unsupported bodies are drawn in a straight line towards the centre of the earth.

Q. 48.—How would bodies fall in vacuo?

A.—At uniform rates.

Q. 49.—How do bodies lighter than air act?

A.—They rise until they arrive at a stratum of air equal in density to themselves.

Q. 50.—How do bodies heavier than air descend?

A.—At rates in proportion to their surfaces and densities.

Q. 51.—How does the fall of a body increase?

A.—According to the square of the time the body is exposed to the influence of gravitation.

Q. 52.—Show how you find, (1) the velocity of a falling body at the end of each second, (2) the space fallen through in each second, and (3) the total space fallen in the second.

A.—

Seconds.	Velocity at end of each second.	Space fallen through in the second.	Total space fallen.
1	$1 \times 32 = 32$	16	$1^2 \times 16 = 16$
2	$2 \times 32 = 64$	$1 \times 32 + 16 = 48$	$2^2 \times 16 = 64$
3	$3 \times 32 = 96$	$2 \times 32 + 16 = 80$	$3^2 \times 16 = 144$
4	$4 \times 32 = 128$	$3 \times 32 + 16 = 112$	$4^2 \times 16 = 256$

Q. 53.—What retards the velocities of falling bodies?

A.—The resistance of the air.

Q. 54.—What is the 'centre of gravity' of a body?

A.—The point in which the weight of the body centres, on which point, if supported, the whole body would balance in any position.

Q. 55.—What is 'specific gravity'?

A.—The weight of one body as compared with that of another.

Q. 56.—What is a 'concentric body'?

A.—A body whose centre of figure and centre of gravity coincide.

Q. 57.—What is an 'eccentric body'?

A.—A body whose centre of figure and centre of gravity do not coincide.

Q. 58.—What is 'retardation'?

A.—The resistance offered by the air to the projectile.

Q. 59.—On what does the amount of retardation experienced by the projectile depend?

A.—On the resistance of the air, and on the power of the projectile to overcome it.

RESISTANCE OF THE AIR, AND PATH OF A PROJECTILE.

Q. 60.—What is the pressure of the air on the square inch?

A.— $14\frac{3}{4}$ lbs., the barometer standing at 30 inches.

Q. 61.—How does the air affect the path of a projectile?

A.—By its resistance.

Q. 62.—How does the resistance of the air vary?

A.—According to the velocity in the same body, the greater the velocity the greater the resistance experienced.

Q. 63.—What is the cause of the irregularities which occur in the flight of rifle projectiles?

A.—The resistance of the air.

Q. 64.—What were the ideas entertained at various times as to the path of a projectile?

A.—(1) That it went straight and then fell perpendicularly.

(2) That it went straight for some distance, then in a curve, and then fell perpendicularly.

(3) That its flight was curved throughout, but, according to Tartaglia in the sixteenth century, so slightly, that he compared it to the surface of the sea.

(4) That it described a parabola.

Q. 65.—What is a parabola?

A.—The section of a cone cut by a plane parallel to one of its sides.

Q. 66.—Who first approximated to the true path of a projectile?

A.—Robins, in 1742.

Q. 67.—How did he calculate the air's resistance?

A.—To vary as the squares of the velocities up to about 1100 feet per second. "If the velocity," he says, "be greater than 1100 feet or 1200 feet a second, then the absolute quantity of that resistance, in these greater velocities, will be near three times as great as it should be by a comparison with the smaller velocities."

Q. 68.—For what is this change in the amount of resistance remarkable?

A.—As occurring at nearly the same rate at which sound is propagated through the air. (Sound travels at 373 yards a second.)

Q. 69.—What were the results of Dr. Hutton's experiments (1775-1791) with regard to the Newtonian law of the air's resistance to a body in motion?

A.—He discovered that the Newtonian law of the

air's resistance to a body in motion being as the squares of the velocities, did not hold good even for the lowest velocities of cannon balls, and at 1100 feet per second, instead of answering to that law it was 1.86 times as much.

Q. 70.—What was the formula adopted by Dr. Hutton to denote this resistance?

A.—He adopted an expression of two terms (one varying as the square, and the other as the first power of the velocity), or

$$R = a v^2 + b v,$$

where R is the resistance corresponding to a velocity v , and a b are coefficients, or multipliers determined from a series of experiments.

Q. 71.—What was the formula deduced by General Piobert?

A.—A formula of two terms, one varying as the square, and the other as the cube of the velocity, or

$$R = A b v^2 (1 + c v),$$

in which A is the sectional area of the projectile, and b and c are coefficients formed by careful experiments.

Q. 72.—What did both M. H  lie and Mr. Basforth demonstrate with regard to the resistance of the air to a body in motion?

A.—That although no simple law could be found to express the resistance of the air in the terms of the velocity, yet that such resistance could be accurately defined by the help of a variable coefficient depending (1) upon the form of the projectile, and (2) upon the velocity with which it moves.

Q. 73.—What expression does Mr. Basforth adopt?

A.— $R = k v^3$; where k , instead of being a fixed multiplier as in all the preceding expressions, is a coefficient not only depending upon the form of the projectile, but also varying in amount for every 50 or 100 feet of velocity.

Q. 74.—Under how many forces is the bullet at the instant of starting from its position next the charge, and what are these forces?

A.—Three: viz., the force of the exploded gunpowder; the force of gravity; and the resistance of the air.

Q. 75.—What would be the course of the bullet were it acted upon by the first of these three forces only?

A.—It would travel forward equal spaces in equal times.

Q. 76.—What would be the effect on the projectile if it were acted upon by the first two of these forces only?

A.—The projectile would travel forward equal spaces in equal times, and also, in obedience to the law of gravity, it will fall in the first second 16 feet, at the end of the second second it will have fallen 64 feet, and at the end of the third second 144 feet.

Q. 77.—By what is the parabolic curve most nearly approached?

A.—By projectiles travelling with very small velocities.

Q. 78.—What is the sole cause of the course of the bullet being in a curved line?

A.—The existence of the force of gravity.

Q. 79.—How will the amount of elevation, which owing to the force of gravity it is necessary to give to all arms, vary?

A.—In an increasing ratio according to distance if this force acted on the bullet in vacuo; but acting as it does in conjunction with the resistance of the air, which greatly increases the curve, the ratio of the elevation necessary is greatly augmented.

Q. 80.—How will the flight of the bullet be modified by the resistance of the air acting in conjunction with the other two forces, namely, the force of the exploded gunpowder and the force of gravity?

A.—Instead of proceeding forward equal spaces in equal times, the spaces traversed will be successively less and less.

Q. 81.—How does this retardation vary?

A.—According to the sectional area, content, density, and velocity of the shot.

Q. 82.—How do you calculate the areas and contents of spheres?

A.—The areas of spheres are as the squares of their diameters; the contents of spheres as the cubes of their diameters.

Q. 83.—How will two spherical shot of the same diameter, the one of lead the other of iron, travelling with the same velocity, experience retardation?

A.—The retardation of the leaden projectile will be less than that of the iron, and inversely as their densities.

Q. 84.—How does retardation affect spheres of different diameters?

A.—In proportion to the squares of their diameters.

Q. 85.—How will spherical shot of the same density and diameter, travelling with unequal velocities, experience retardation?

A.—In proportion to the squares of their velocities.

Q. 86.—How will spherical shot of different diameters, but of the same weight and moving with the same velocity, be retarded?

A.—In proportion to the squares of their diameters.

Q. 87.—How will spherical shot of different diameters, and of the same density, moving with the same velocity, experience retardation?

A.—As the squares of their diameters, and inversely as their weights or the cubes of their diameters.

Q. 88.—How if moving with different velocities?

A.—Then as the squares of their diameters into the squares of their velocities, and inversely as their weights or the cubes of their diameters.

Q. 89.—What are the principal causes of the deviations which occur in the flight of projectiles?

A.—The eccentricity of the projectile, windage, and the deflection caused by the rotation which the bullet receives from its last impact on leaving the bore.

Q. 90.—How does the rotatory motion, received by

a ball striking the ground at an angle less than a right angle, increase?

A.—It increases the smaller the angle of incidence.

Q. 91.—Round what axis does a bullet receive rotation on its last impact, and in rebounding from the sides of the barrel?

A.—Round an axis at right angles to its line of flight.

Q. 92.—How does a ball rotate if it strikes the right of the barrel at its last impact?

A.—From left to right.

Q. 93.—In what direction must the force be impressed upon a body so that it may have no motion of rotation?

A.—In the direction of its centre of gravity.

Q. 94.—How will a body rotate if the force impressed does not pass through the centre of gravity?

A.—It will rotate round an axis passing through the centre of gravity, and at right angles to the plane containing the line representing the impressed force and a line perpendicular to it passing into the centre of gravity.

Q. 95.—On what does the direction of this axis depend?

A.—Upon the position of the centre of gravity with regard to the centre of figure.

Q. 96.—How would a bullet rotate whose centre of gravity was above its centre of figure?

A.—The lower part would turn upwards, and the bullet would revolve in this direction on an horizontal axis.

Q. 97.—Why would the lower part of the bullet have a tendency to turn up?

A.—Because a greater amount of force would be impressed on the part of the bullet below the centre of gravity than above it.

Q. 98.—In what case would this principle not apply?

A.—When the centre of gravity, although not in

the centre of figure, was in the same direction or line with the impressed force and the centre of figure.

Q. 99.—How did Robins explain the effect of the rotation originating from windage, or from the eccentricity of the projectile?

A.—He states that, “this whirling motion of the bullet occasions it to strike the air obliquely, and thereby produces a resistance which is oblique to the track of the bullet, and consequently perpetually deflects it from its course.”

Q. 100.—To which side is the bullet deflected?

A.—To that side where there is least resistance offered, which will be in the opposite direction to the deflection caused by the rebound of the bullet from its last impact upon leaving the bore.

Q. 101.—Will the track of the spherical ball be the curve depending simply upon the three forces, viz., gunpowder, gravity, and the resistance of the air?

A.—No.

Q. 102.—What then does this curve become?

A.—A double curve, the bullet being deflected to the right or left according to the position of the centre of gravity, when the gun is loaded, or according to the rotation acquired by the ball rebounding from the side of the barrel.

Q. 103.—How did Robins illustrate this deviation?

A.—By suspending a wooden ball by a double string to the ceiling, the ball was turned round, and the string twisted; when left to itself the ball rotated from the untwisting of the string; but if drawn considerably from the perpendicular, it vibrated steadily at first in the same vertical plane in which it began to move; as the string untwisted it acquired a sufficient degree of rotation, and began to deflect to the right or left of its proper track.

Q. 104.—By what experiment did Robins elucidate the deflection caused by the rotation of a projectile round an axis not coincident with its line of flight?

A.—He took a barrel and bent it to the left at an

angle of 3° or 4° , he then fired it with a loose ball through two paper screens at a wall: the first screen was 50 feet, the second 100 feet, and the wall 300 feet, from the barrel; he found that the bullet had struck $1\frac{1}{2}$ inch to the left of the centre of the first screen; in the second screen about 3 inches to the left, while on the wall the mark of the bullet was found about 14 inches to the right.

Q. 105.—What kind of projectiles will be the most accurate in their flight?

A.—All other things being equal, the largest, most dense, and most perfectly formed balls.

Q. 106.—Why had General Piobert's tack ball greater accuracy than the ordinary ball?

A.—Because rotation was prevented.

Q. 107.—What accuracy compared with other balls?

A.—Four times the accuracy.

Q. 108.—By what is the course of a bullet, whether spherical or elongated, always described?

A.—By its centre of gravity.

Q. 109.—Would any rotation be necessary to correct the flight of the bullet in vacuo?

A.—No.

Q. 110.—What is the sole cause of projectiles upsetting from their true path?

A.—A medium through which they must pass.

Q. 111.—How do spherical and elongated projectiles naturally rotate, owing to the resistance they meet with from the air?

A.—Spherical shot rotate round an accidental axis passing through their centre of gravity, and elongated projectiles round the short axis also passing through the centre of gravity.

Q. 112.—Round what axis should the rotation be, in order to correct the flight of the projectile; and why?

A.—Round an axis coincident with its initial direction; rotation in any other direction would only cause inaccuracy.

Q. 113.—What is the most perfect form for rotation?

A.—The disc.

Q. 114.—Why?

A.—Because when its rotation is round any axis but the shortest, the constant tendency is to return to this.

Q. 115.—Why is the disc useless as a projectile?

A.—In consequence of the great retardation it would experience.

Q. 116.—What is the object of rifling?

A.—To give rotation to the projectile, in order to ensure its stability at the longer ranges.

Q. 117.—What effect has the length of the bullet on its stability?

A.—The longer the bullet the less the stability, and, consequently, the greater rotation required.

Q. 118.—What would be the effect if the rotation became too weak at any part of the range?

A.—The bullet would wobble, and deviation therefore ensue.

Q. 119.—Does a rapid twist decrease velocity?

A.—No.

Q. 120.—By what is the degree of spirality influenced?

A.—By the strength of the barrel; a quick twist requiring a stronger barrel than a slow one.

Q. 121.—Why will a ricochet deviate more with a rapid twist?

A.—Because the velocity of rotation, being less than that of translation, diminishes but slowly, while the resistance of the air diminishes rapidly the forward motion of the shot.

Q. 122.—What is the velocity of rotation imparted to a shot influenced by?

A.—By the length of the shot, its density, and the position of its centre of gravity.

Q. 123.—Why will leaden projectiles require a smaller amount of rotation than iron ones?

A.—Because the density of lead is greater than that of iron.

Q. 124.—What is the best position for the centre of gravity of an elongated shot fired from a rifle?

A.—As near the head of the shot as possible.

Q. 125.—Why will a greater rotation be required to keep the bullet point first when the centre of gravity is near the rear?

A.—Because the resistance on that part of the bullet in rear of the centre of gravity is much reduced, while the power of the direct action of the air on the front of the bullet is much increased in consequence of its distance from the centre of gravity and the greater leverage.

Q. 126.—What will the bullet have a tendency to do when the centre of gravity is near the rear, and the rotation is weak?

A.—To turn over.

Q. 127.—How will an elongated projectile rotate whose centre of gravity does not lie in its long axis?

A.—An irregular rotation will take place round an axis passing through its centre of gravity, parallel to the long axis.

Q. 128.—How will the spin of the bullet, in this case, be impaired?

A.—In proportion to the distance of the axis of rotation from the long axis.

Q. 129.—Why is a more powerful rotation necessary in windy or boisterous weather to keep the axis in its true direction?

A.—Because the lighter end of the bullet is more easily acted upon by the wind than the heavier; supposing the lighter end were in the rear this part would be pressed to leeward, and the front and axis directed to windward; if its lighter end were in the front the bullet would turn on its short axis, and its heavy end would try and go first.

Q. 130.—What is indispensable for a military rifle to be serviceable?

A.—A rapid rotation to keep the bullet stable under all circumstances.

Q. 131.—How does the air act upon a bullet whose axis is not a tangent to the trajectory?

A.—It acts on its lower surface, and the more so the more the bullet preserves its parallelism to the line of fire; so that the bullet meets with greater resistance than if the axis is kept in the direction of the trajectory, and the range will be lessened.

Q. 132.—What mode is generally adopted to throw the centre of gravity forward?

A.—Hollowing the base, and blunting or rounding the point.

Q. 133.—Define 'drift.'

A.—The tendency of the bullet to deviate from its initial direction.

Q. 134.—What affects the drift of the bullet?

A.—"The greater the velocity of rotation with the same velocity of translation the greater will be the drift." "The greater the range and the greater the angle of descent the greater will be the drift."

Q. 135.—What is the direction of the rotation of all English rifling?

A.—To the right, so that the lower portion of the bullet passes from right to left.

Q. 136.—How do you account for bullets working or drifting to the right?

A.—The lower half of the bullet travels on compressed air, the upper on rarefied; the result is that the bullet rotates on the compressed air and so works to the right.

Q. 137.—In what direction would the drift be if the rifling was to the left?

A.—The drift would be to the left.

Q. 138.—What have been the suppositions as to the angle the axes of elongated bullets preserve to the trajectory during their flight?

A.—By some that the bullet preserves its primary direction, and by others that they form a tangent to the trajectory.

Q. 139.—How does the density, or hygrometric, state of the atmosphere affect the flight of the bullet?

A.—The denser the atmosphere the greater the resistance and retardation, consequently the lower the bullet will strike; the rarer the atmosphere the less the resistance, and the higher the bullet will strike.

Q. 140.—Which of two shots, the one elongated, and the other spherical, both of the same diameters, taken transversely, has the greatest initial velocity?

A.—The spherical shot.

Q. 141.—Which experiences least resistance?

A.—The elongated shot.

Q. 142.—Why?

A.—Because it has the greater weight to overcome the resistance.

Q. 143.—Which has the longest range?

A.—The elongated projectile.

PENETRATION.

Q. 144.—What is the meaning of the term ‘vis viva’?

A.—The potential energy, or mechanical power of the projectile.

Q. 145.—What is the measure of mechanical power?

A.—“The mass of the body multiplied by the square of its velocity.”

Q. 146.—How then is ‘vis viva’ mathematically expressed?

A.— $M V^2$.

Q. 147.—How does ‘momentum’ differ from ‘vis viva’?

A.—The momentum is the mass multiplied by the velocity, or $M V$, while vis viva is the mass multiplied by the velocity squared, or $M V^2$.

Q. 148.—Which increases the penetrative power of a projectile, increasing its weight or increasing its velocity?

A.—Increasing its velocity.

Q. 149.—On what does penetration depend?

A.—On the velocity at the time of impact or final velocity, density, and rotation, when the figures of the shot are similar.

Q. 150.—Why will the penetrative power of a spherical shot be greater than that of an elongated shot at very short ranges?

A.—Because it has at first a greater velocity.

Q. 151.—How would increasing or decreasing the rotation affect the penetration, and the range?

A.—Increasing the rotation increases the penetration, while decreasing the rotation decreases the penetration; and increasing or decreasing the rotation will produce increased or decreased range.

Q. 152.—How, and why are bullets hardened?

A.—Bullets are hardened with $\frac{1}{10}$ th of tin, in order to give them greater penetrative power.

Q. 153.—Which form of bullet is best adapted for the rifle?

A.—The elongated form.

Q. 154.—What enables us to have our shot pointed?

A.—The use of chilled iron.

Q. 155.—What must the form of the head of a projectile depend upon?

A.—The material of which it is composed.

Q. 156.—For what purpose is the base of the bullet hollowed out?

A.—To throw the centre of gravity forward.

Q. 157.—What should the shape of the body of the bullet be on leaving the rifle?

A.—As near that of a cylinder as possible.

Q. 158.—Why?

A.—Because this shape experiences the smallest resistance from the air in its rotation, and ought to produce the least drift.

Q. 159.—Why will a longer bullet experience less retardation than a shorter one?

A.—Because it has a greater mass to overcome the resistance.

Q. 160.—What are the advantages and disadvantages of a very long bullet?

A.—The advantages are that it experiences less retardation, it has greater penetration, and a flatter trajectory; the disadvantages, that a side wind has a greater effect upon it, it has a lower initial velocity with the same charge, and a greater rotation is required.

Q. 161.—In what proportion should the length of a bullet be to its diameter?

A.—Generally from two to three diameters, those for small bores being of the greater length.

Q. 162.—With what should the initial velocity be consistent?

A.—It should be as great as possible consistent with the strength of the barrel, the preservation of the shape of the bullet, and the recoil.

Q. 163.—What will be the best and most effective rifle?

A.—That rifle from which the bullet can be projected with the greatest initial velocity, combined with the greatest possible power of overcoming the air's resistance, thus producing the lowest trajectory and the greatest destructive effect at all distances.

HISTORY OF GUNPOWDER.

Q. 164.—Have we any certain information as to how, when, or by whom, gunpowder was invented?

A.—No.

Q. 165.—Where was gunpowder first known?

A.—In India and China.

Q. 166.—For what purpose was gunpowder first used?

A.—For fireworks.

Q. 167.—How is it supposed that gunpowder was first discovered?

A.—“From the primeval mode of cooking food by
Q 2

means of a wood fire on a soil strongly impregnated with nitre; as it is in many parts of India and China."

Q. 168.—Where and when was gunpowder first used in warfare?

A.—At the siege of Mecca, A.D. 690.

Q. 169.—Trace how gunpowder was introduced into Europe.

A.—The Arabs, who derived it from the Indians, availed themselves of its advantages in their wars with the Spaniards; from Spain the use of gunpowder passed to France, and thence it gradually extended itself over the other states of Europe.

Q. 170.—When was gunpowder first manufactured in England?

A.—In the reign of Edward III., 1346.

Q. 171.—In what battle is gunpowder supposed to have been first used by the English?

A.—According to Froissart, gunpowder was used by the English at the battle of Cressy (1346).

Q. 172.—When was the manufacture of gunpowder fairly established in England?

A.—In the reign of Queen Elizabeth.

Q. 173.—In what form was gunpowder at first?

A.—Dust, or fine meal.

Q. 174.—What was the composition of the earliest powder?

A.—Equal parts of saltpetre, charcoal, and sulphur.

Q. 175.—What was the composition of the powder mentioned by Marcus Græcus?

A.—Six parts of saltpetre, two of charcoal, and two of sulphur.

Q. 176.—What was the composition of powder for cannon and muskets in Tartaglia's time (1537)?

A.—Cannon powder was composed of four parts of saltpetre, one of charcoal, and one of sulphur. That for muskets forty-eight parts of saltpetre, eight of charcoal, and seven of sulphur, or eighteen of saltpetre, three of charcoal, and two of sulphur.

Q. 177.—Why was graining introduced?

A.—To increase the strength of the powder, to make it more convenient for filling into small charges, and for charging small arms.

Q. 178.—What name was given to meal powder in the time of Edward VI.?

A.—Serpentine powder.

Q. 179.—Why did graining powder give it additional strength?

A.—Because it allowed a free passage of the flame between the grains.

Q. 180.—When was saltpetre first manufactured in England?

A.—In the reign of Queen Elizabeth.

Q. 181.—From whence was saltpetre procured at this time?

A.—From Barbary, France, Poland, and Germany.

Q. 182.—When was recourse had to corn or grained powder?

A.—About 1600, though it was not in general use until the reign of Charles I.; the powder for priming remaining ungrained.

Q. 183.—Who ordered powder to be proved?

A.—James I., in 1623.

Q. 184.—By whom, and in what year, were powder mills erected in Surrey?

A.—By the East India Company, about 1626.

Q. 185.—When did the quantity of gunpowder made in England become equal to the demand?

A.—In the reign of Charles II.

Q. 186.—How did Government obtain their chief supply of saltpetre in the reign of William III?

A.—A company formed in 1692 for the purpose of making and refining saltpetre was bound to furnish Government with 1000 tons annually; and the East India Company, in 1693, was bound to furnish Government with 500 tons of saltpetre annually.

Q. 187.—When were powder works first established at Waltham Abbey?

A.—In 1561.

PROPERTIES OF GUNPOWDER.

Q. 188.—What are the objects to be attained in an explosive compound?

- A.—(1) The maximum of propelling force.
(2) The minimum of initial pressure in the bore of the gun.
(3) Uniformity of action.
(4) Freedom from fouling.
(5) Durability.

Q. 189.—What is the composition of English Government powder?

A.—75 parts of saltpetre, 15 of charcoal, and 10 of sulphur.

Q. 190.—What is the composition of French powder?

A.—75 parts of saltpetre, and 12·5 parts of charcoal and sulphur.

Q. 191.—What are the advantages of gunpowder?

- A.—(1) The ingredients are easily procured.
(2) They are comparatively cheap.
(3) It is, with proper precautions, safe in manufacture, in store, and in transport.
(4) Its rate of combustion is gradual compared with most other explosive compounds.

Q. 192.—Why should the greatest care be taken in the processes of refining the ingredients?

A.—In order that they should be absolutely free from impurity, and also to prevent the introduction of any foreign matter.

Q. 193.—What is saltpetre?

A.—Saltpetre is a natural production, found on the surface of the earth.

Q. 194.—Of what is it composed?

A.—Of 54 parts of nitric acid and 46 of potash.

Q. 195.—How does it act?

A.—As a magazine of oxygen in a solid form, one volume of saltpetre containing as much oxygen as

3000 volumes of atmospheric air, this oxygen with which it parts when raised to a certain temperature, combines violently with the carbon to form carbonic oxide and carbonic acid, which, with free nitrogen, form the chief gaseous products of combustion.

Q. 196.—What is charcoal?

A.—A form of carbon, with a very small proportion of foreign matters.

Q. 197.—What is the quality of the powder materially affected by?

A.—By the quality of the charcoal.

Q. 198.—On what does the quality of the charcoal depend?

A.—On the description of wood used, and the manner in which it is burnt.

Q. 199.—What are the best woods for charcoal?

A.—Dogwood, willow, alder, and filbert.

Q. 200.—What wood makes the strongest powder?

A.—Dogwood.

Q. 201.—Why is charcoal prepared at a low temperature better than if it were prepared at a higher heat?

A.—Because it is softer, more inflammable, and contains more gaseous elements.

Q. 202.—What are the disadvantages of preparing charcoal at a low temperature?

A.—It is more hygroscopic, and therefore more liable to suffer from damp.

Q. 203.—What is sulphur?

A.—A natural product.

Q. 204.—What is the chief value of sulphur as an ingredient of gunpowder?

A.—The low temperature at which it inflames, about 560° F., thus facilitating ignition.

Q. 205.—How does sulphur accelerate combustion?

A.—Its oxidation by saltpetre produces a higher temperature than is obtained with charcoal, and increases by expansion the volume of gas evolved.

Q. 206.—Why would an excess of saltpetre be injurious?

A.—Because it would increase the fouling.

Q. 207.—What other quality in sulphur makes it valuable as an ingredient of gunpowder?

A.—Its non-absorbent quality, which makes the powder more durable, compact, and able to bear transport better.

Q. 208.—What is the most important process in the manufacture of gunpowder?

A.—The milling or incorporating process.

Q. 209.—Why?

A.—Because nothing that can be done to the powder afterwards can remedy defects in the incorporation.

Q. 210.—What is the best test for thorough incorporation?

A.—Flashing.

Q. 211.—How may a perfectly and an imperfectly made powder be told by this process?

A.—A perfectly made powder flashes off, leaving nothing but some smoke marks, whereas an imperfectly made powder will leave specks of undecomposed saltpetre on the glass.

Q. 212.—Define 'explosiveness.'

A.—The rate at which powder burns or is converted into gas.

Q. 213.—On what will 'explosiveness' depend?

A.—(1) The density of the powder.

(2) Its hardness.

(3) Size of grains.

(4) Shape of grains.

(5) Amount of glaze.

Q. 214.—What affects the explosiveness of powder more than anything else?

A.—Its density.

Q. 215.—What do you understand by the 'density of a powder'?

A.—The quantity of meal present in a certain bulk of the powder.

Q. 216.—Has hardness necessarily a relation to density?

A.—No, for a substance may be hard and yet possess little density.

Q. 217.—How can increased density be given?

A.—By compressing a certain quantity of meal into a smaller bulk.

Q. 218.—How can increased hardness be given?

A.—By pressing the meal in a moist condition.

Q. 219.—How do you obtain uniform density?

A.—By compressing a certain quantity of meal into a certain space.

Q. 220.—How will the amount of compression given to each description of powder vary?

A.—With the season.

Q. 221.—How does the actual pressure per square inch of the hydraulic ram vary?

A.—With the weather, and the more or less percentage of moisture present in the meal.

Q. 222.—How is the density tested?

A.—By the mercurial densimeter.

Q. 223.—How does increasing or decreasing the density affect the initial velocity?

A.—Increasing the density decreases the initial velocity, and decreasing the density increases the initial velocity.

Q. 224.—Why is it that a less dense powder gives a higher initial velocity?

A.—Because it burns more rapidly than a dense powder.

Q. 225.—How does the density of the powder affect 'fouling'?

A.—The slower the action of the charge, and therefore the more dense the powder, the less will be the fouling.

Q. 226.—How does density affect durability?

A.—A dense hard powder will take a higher glaze, and will therefore bear transport better, and not be so easily affected by moisture.

Q. 227.—How does the size of the grains modify explosiveness?

A.—Both ignition and combustion are gradual; the flame is communicated from one grain to another, each burning in concentric layers until it is consumed, so that the combustion of the grains is not simultaneous; a large grain powder allows of more rapid ignition, owing to the interstices between the grains being larger.

Q. 228.—Why is it that although mealed powder ignites very readily, a much longer time is required for its complete combustion than when the powder is granulated?

A.—Because the minuteness of the interstices in the mealed powder prevents the free transmission of the flame.

Q. 229.—Supposing two grains or pieces of powder of equal size, similar shape, but unequal in density, were burnt on a plate, which would be first consumed?

A.—The less dense grain.

Q. 230.—Would two grains of equal density but of different shapes take the same time to burn?

A.—No; the grain exposing the largest surface will be the quickest in its combustion.

Q. 231.—Which is the most favourable form for the transmission of the flame?

A.—The rounded form.

Q. 232.—Why?

A.—Because the interstices are larger and more regular than in the case of elongated or flat grains.

Q. 233.—How, then, can uniformity of action in charges of powder be secured?

A.—The grains of each charge must be as much of a size and shape as possible.

Q. 234.—How does glazing affect explosiveness?

A.—By presenting a smooth surface to the flame it retards ignition, and thereby materially affects the explosiveness.

Q. 235.—What are the beneficial effects of glazing?

A.—It enables the powder to withstand damp, and bear transport better, thus rendering it more durable.

Q. 236.—How does damp reduce explosiveness?

A.—By using up a certain amount of the heat generated by the combustion in order to overcome the moisture, it also tends to separate the ingredients of the powder.

Q. 237.—Why is weighing charges of powder to be preferred to measuring?

A.—Because by weighing not only the same volume but the same quantity is obtained.

EFFECTS OF COMBUSTION.

Q. 238.—Describe the effect produced by a charge of gunpowder being burnt in a confined space.

A.—A large quantity of gases are generated in a highly condensed state, these gases exert a pressure equal in every direction, being also materially aided by the heat evolved.

Q. 239.—How is the pressure or tension of gases measured?

A.—By so many atmospheres, each atmosphere being at the ordinary pressure of $14\frac{3}{4}$ lbs. on the square inch.

Q. 240.—What effect has increasing or decreasing the temperature upon air or any other gas?

A.—It is uniformly expanded by an increase, and uniformly contracted by a decrease of temperature.

Q. 241.—By an increase of how many degrees is the volume of air doubled, if the 'pressure' remain constant?

A.—By an increase of 480° F.

Q. 242.—By an increase of how many degrees is the tension or expansive force doubled if the volume remain constant?

A.— 480° F.

Q. 243.—What is a great promoter of chemical action?

A.—Heat.

Q. 244.—Why?

A.—Because, when substances having chemical affinity for one another are intimately mixed the application of heat increases the rapidity of combination.

Q. 245.—What amount of work did M. de Saint Robert determine was lost by the heat communicated to the gun?

A.—About 250 gramme-units per gramme of powder 'in the case of a rifled musket.'

Q. 246.—What did Nobel and Abel estimate this loss to be in a 10-inch gun?

A.—25 gramme-units per gramme of powder.

Q. 247.—What do you understand by the term 'factor of effect'?

A.—A term applied to the percentage of the maximum possible theoretic work which is actually obtained for every rifled gun.

Q. 248.—What is this loss chiefly due to?

A.—To the communication of heat to the bore of the gun.

Q. 249.—How should the heat be regulated in order to give uniform results?

A.—It should be as regular as possible.

Q. 250.—How is the actual pressure in the bore of the gun ascertained?

A.—By means of crusher gauges inserted in the bore of the proof gun.

Q. 251.—What is the chronoscope?

A.—An instrument by which the velocity of the projectile in the bore from point to point is ascertained.

Q. 252.—What is the great object to be attained in the manufacture of powder?

A.—That the powder should be suited to the particular arm with which it is to be used.

Q. 253.—What influences the pressure produced in the bore of a gun by the combustion of a charge of powder?

A.—The length and shape of the cartridge, the cubic space per lb. of powder occupied by the charge, and the point at which the charge is ignited.

MANUFACTURE OF GUNPOWDER.

Q. 254.—What are the different kinds of powder now in use in our services, and for what arms are they severally used?

A.—R.L.G. (rifle large grain, $\frac{1}{4}$ to $\frac{1}{2}$ inch), used for breech and muzzle loading rifled guns.

R.F.G. (rifle fine grain, $\frac{1}{12}$ to $\frac{1}{16}$ inch), for the Snider rifle.

R.F.G.² ($\frac{1}{12}$ to $\frac{1}{16}$ inch), for the Martini-Henry rifle.

P. (pebble powder, $\frac{5}{8}$ -inch cubes), used for battering charges for heavy guns.

P.² ($1\frac{1}{2}$ -inch cubes), used for 35 and 38-ton guns.

Q. 255.—How are the sizes of grained powders described?

A.—By the number of meshes to the linear inch contained in the sieves which determine their larger and smaller limits of size.

Q. 256.—What mesh powders are R.F.G. and R.F.G.²?

A.—From 12 to 20 mesh powders.

Q. 257.—From what countries is saltpetre principally procured?

A.—India, China, and Bengal.

Q. 258.—Why is it at first quite unfit for the manufacture of gunpowder?

A.—Because it is combined with earths and salts,

which have to be extracted previously to its being used in the manufacture of gunpowder.

Q. 259.—Why would the salts especially be injurious?

A.—On account of their powers of absorbing moisture.

Q. 260.—In what countries is saltpetre produced artificially?

A.—In France and Germany.

Q. 261.—Describe the process.

A.—Animal refuse of all kinds is mixed with old mortar and earth, and placed in heaps under sheds, where it is protected from the rain but exposed to the air. These heaps are watered with putrid urine from time to time, and thus nitre and nitrate of lime are produced.

Q. 262.—What is the term applied to saltpetre previous to its purification?

A.—Grough saltpetre.

Q. 263.—Where, and how, is saltpetre purified?

A.—At Waltham Abbey, by distillation.

Q. 264.—What kind of wood is best suited for the manufacture of powder?

A.—Light and spongy wood of not more than ten years growth.

Q. 265.—What is wood charcoal?

A.—The woody fibre that remains after the liquid and more volatile parts have been removed by charring.

Q. 266.—What is the object of charring wood?

A.—To remove moisture, and to expel those matters which become volatile before they are burned.

Q. 267.—How may wood be charred?

A.—It may either be charred in the ordinary way in pits, or by distillation in large iron cylinders.

Q. 268.—Which is considered the best method, and why?

A.—Distillation, because the operation is more com-

plete, and the charcoal rendered more free from foreign matters.

Q. 269.—What does the quality of the charcoal materially affect?

A.—The rapidity of combustion.

Q. 270.—Where is dogwood procured?

A.—From Sussex, Belgium, and Holland.

Q. 271.—For what powders are alder and willow used?

A.—Powders for field and heavy ordnance.

Q. 272.—What wood is used for small-arm powder?

A.—Dogwood.

Q. 273.—What percentage should wood give in charcoal?

A.—From 25 to 26 per cent. by weight of charcoal.

Q. 274.—When should wood for charcoal be cut?

A.—In the spring, when the sap is up.

Q. 275.—Is sulphur soluble in water?

A.—No.

Q. 276.—In what, then, is it soluble?

A.—In oils, or alcohol.

Q. 277.—When does it begin to evaporate?

A.—At 170° F.

Q. 278.—When to melt?

A.—216° F.

Q. 279.—When does it become liquid?

A.—Between 230° and 270° F.

Q. 280.—At what temperature does it boil?

A.—At 600° F.

Q. 281.—From what country is sulphur principally procured?

A.—From Sicily.

Q. 282.—How, and where, is sulphur purified?

A.—By distillation, at Waltham Abbey.

Q. 283.—Detail briefly the processes through which gunpowder passes, in its manufacture at Waltham Abbey.

A.—(1) Purification of the ingredients, pulverizing and sifting the charcoal and sulphur.

(2) Mixing the ingredients.

(3) Incorporation and proof of the mill cake.

(4) Breaking down the mill cake.

(5) Pressing.

(6) Granulating.

(7) Dusting.

(8) Glazing.

(9) Stoving.

(10) Finishing, or final dusting.

(11) Proof.

Q. 284.—What is the largest charge authorized for the incorporating mill for small-arm powder?

A.—50 lbs.

Q. 285.—What for cannon powders?

A.—60 lbs.

Q. 286.—What is the charge called when first laid on the bed of the mill?

A.—Green charge.

Q. 287.—How long is R.F.G. under the stone, or iron runners?

A.— $5\frac{1}{2}$ hours under the stone, or 4 hours under the iron runners.

Q. 288.—How long is R.F.G.² under the runners?

A.—Between 7 and 8 hours.

Q. 289.—What amount of moisture does the charge contain when placed on the bed of the mill?

A.—About 2 pints of water (the moisture of the salt-petre).

Q. 290.—What further quantity is required, and why?

A.—From 2 to 6 or 7 pints of distilled water, in order to facilitate the incorporation, and reduce the effect of an explosion.

Q. 291.—What would be the effect if the charge was too wet?

A.—The runners would take up the composition from the bed.

Q. 292.—What is the action of the runners?

A.—Rolling and twisting.

Q. 293.—What is the effect of the runners?

A.—Crushing, grinding, and mixing.

Q. 294.—How is the charge named when it is ready to be taken off the mill?

A.—Mill cake.

Q. 295.—What should be the appearance of the mill cake?

A.—It should be equal in appearance, no specks of saltpetre or sulphur should be visible to the eye, and it should be of a light brown colour.

Q. 296. Why should the incorporation be attended to by experienced men?

A.—Because the whole goodness and uniformity of the powder depends upon this process.

Q. 297.—How often should the mill cake be tested, and why?

A.—Every day, in order to ascertain whether it contains the proper amount of moisture.

Q. 298.—What should the percentage of moisture be for R.F.G., R.F.G.², and for the larger descriptions of powder?

A.—R.F.G. $1\frac{3}{4}$ per cent., R.F.G.² $2\frac{3}{4}$ per cent., and 4 per cent. for the larger descriptions of powder.

EXAMINATION AND PROOF OF POWDER.

Q. 299.—How can the colour, glaze, and hardness of the powder be tested?

A.—By the hand and eye alone.

Q. 300.—How can the cleanness of the powder be tested?

A.—By pouring a quantity two or three feet above the barrel in a good light; if there be any loose dust it will be readily detected.

Q. 301. How may thorough incorporation be tested?

A.—By 'flashing.'

Q. 302.—Describe the process of flashing.

A.—A small quantity of powder is placed in a copper cylinder, which is then inverted on a china or glass plate; this method allows of the powder being arranged in very nearly the same way each time. If the powder is thoroughly incorporated it will 'flash' off when touched with a hot iron, leaving nothing but a few smoke marks; if badly incorporated, specks of undecomposed saltpetre will be left upon the plate.

Q. 303.—How can the shape of the grains be tested?

A.—By the eye alone.

Q. 304.—How can the size and proportion of the grains be tested?

A.—By means of sieves, which define its highest and lowest limits of size.

Q. 305.—How is R.F.G.² powder tested as to size of grains?

A.—By means of two sieves; it should pass through a sieve of twelve meshes to the linear inch, and be retained on one of twenty meshes.

Q. 306.—What does this sifting, however, convey no idea of?

A.—The proportions of the different sized grains contained in the powder.

Q. 307.—How is this obviated in the case of R.F.G.² powder?

A.—A pound is sifted on three sieves, a 12 mesh, a 16 mesh, and a 20 mesh.

Q. 308.—What are the limits allowed?

A.—Pass 12 mesh to 16 mesh	..	12 ozs.
Pass 16 mesh to 20 mesh	..	3 ozs.
Pass 20 mesh .. .. .	..	1 oz.

16 ozs.

Q. 309.—How is the density of a powder tested?

A.—By the mercurial densimeter.

Q. 310.—How much moisture should powder contain?

A.—A percentage of moisture between the limits laid down for each description.

Q. 311.—How is each powder tested?

A.—With the arm in which it is to be used.

Q. 312.—What is the limit of pressure for P and P², and what the mean pressure on powder chamber?

A.—For P powder the limit is 20 tons, and for P² a maximum pressure of 22 tons per square inch, or a mean pressure on powder chamber of 21 tons.

Q. 313.—How are the proportions of the ingredients tested?

A.—By chemical analysis.

HISTORY OF ARMS.

Q. 314.—What were the arms in use at the time Cæsar invaded Britain?

A.—The spear, sword, dagger, battleaxe, and bows and arrows.

Q. 315.—In whose reign were fire-arms introduced?

A.—In the reign of Edward III.

Q. 316.—Is the exact year and country known in which fire-arms were invented?

A.—No.

Q. 317.—What was the earliest description of fire-arm?

A.—The hand-gun.

Q. 318.—Where was the hand-gun first used?

A.—At the siege of Arras, in 1414; some authors, however, state that the siege of Lucca, in 1430, is the most reliable date of the first use of small arms in the field.

Q. 319.—When did hand-guns come into general use?

A.—About 1446.

Q. 320.—What power was the first to arm the foot-soldier with the hand-gun?

A.—Spain.

Q. 321.—Describe the hand-gun.

A.—It was of simple construction, and consisted of an iron or brass tube with a touchhole at the top; this tube was fitted to the end of a straight pole, a cubit and a half long, called the frame of the “gonne;” it had no lock.

Q. 322.—How was it held when about to be fired?

A.—The stock or frame of the “gonne” passed under the right arm.

Q. 323.—How was it fired?

A.—By means of a match.

Q. 324.—What was this match made of?

A.—Of cotton or hemp spun slack, boiled in a strong solution of saltpetre, or in the lees of wine.

Q. 325.—What improvement was made in the hand-gun in 1446?

A.—The touchhole was placed at the side, and a small pan placed under it to hold the priming, with a cover to turn off and on with the hand.

Q. 326.—When, and where, did the first force armed with hand-guns land in England?

A.—At Ravenspur in Yorkshire, in 1471.

Q. 327.—What great improvement took place in fire-arms in the reign of Henry VII.?

A.—A cock was fixed on the hand-gun to hold the match, which was brought down to the priming by a trigger.

Q. 328.—What was the hand-gun subsequently called?

A.—A match-lock, or ‘arc-à-bouche,’ a bow with a mouth, which afterwards became corrupted to harquebus.

Q. 329.—Where was the harquebus supposed to have been invented?

A.—In Italy.

Q. 330.—Is it still in use ?

A.—Yes ; it is still used by the Chinese, Tartars, Sikhs, Persians, and Turks.

Q. 331.—What further improvement was made in the harquebus in the reign of Henry VII. ?

A.—At first it had a straight stock, but during this period it was furnished with a wide butt-end to rest against the right breast.

Q. 332.—What country first introduced the idea of bending the stock ?

A.—Germany.

Q. 333.—What was the harquebus called after this plan was adopted ?

A.—The hackbutt or hagbut, and the smaller sort demihags.

Q. 334.—When and by whom was the pistol invented ?

A.—By Camillo Vitelli, an Italian, about 1540.

Q. 335.—Why was the pistol so called ?

A.—From its having been first made at Pistoia.

Q. 336.—What was the dag or tache ?

A.—A variety of the pistol.

Q. 337.—When was the pistol first used in England ?

A.—In the year 1544, by cavalry.

Q. 338.—What was the wheel-lock ?

A.—An improvement on the match - lock or harquebus.

Q. 339.—Where, and in what year, was it invented ?

A.—At Nuremberg, in 1517.

Q. 340.—Where was it first used ?

A.—At the siege of Parma in 1521.

Q. 341.—When was it brought to England, and how long did it continue in use ?

A.—In 1530, and continued in use until the time of Charles II.

Q. 342.—Describe the wheel-lock.

A.—It consisted of a furrowed steel wheel which protruded into the priming pan ; a strong spring ;

and a cock holding a piece of pyrites; this cock was so fitted that it could be moved backwards or forwards at pleasure, a strong spring being attached to it to keep it in its position. The wheel worked on a spindle, to which the spring was connected by a chain swivel.

Q. 343.—How was the gun discharged?

A.—The lock was wound up by means of a key which fitted on the spindle, the cock was let down to the priming pan, with the pyrites resting against the wheel; on the trigger being pressed, the wheel was released and revolved, when sparks were emitted which set fire to the powder in the pan.

Q. 344.—What were the objections to the wheel-lock?

A.—It frequently missed fire, as the pyrites broke in the pan, and thus impeded the free action of the lock, it was complicated in its construction, difficult to repair, and the priming was exposed to the wet when the pan was uncovered to wind up the lock.

Q. 345.—Why was it not generally adopted?

A.—On account of these defects and its expense.

Q. 346.—What were the various small arms in use in the reign of Henry VIII.?

A.—The hand-gun or harquebus, the hackbutt, and demihague.

Q. 347.—What were the dimensions of the hand-gun and the hackbutt in this reign?

A.—It was enacted that no hand-gun should be used of less dimensions than one yard in length, barrel and stock included, and no hackbutt under three-quarters of a yard.

Q. 348.—Were the harquebus and hackbutt originally of any particular length or bore?

A.—No; they were, according to Hewitt, "of several varieties, breech-loading and muzzle-loading, bell-mouthed and cylindrical."

Q. 349.—To whom is the invention of breech-loading attributed?

A.—To Henry II. of France, in 1540.

Q. 350.—To what fire-arm was the breech-loading principle first applied?

A.—To the harquebus.

Q. 351.—What fire-arm is supposed to have given rise to the pistol?

A.—The demihague.

Q. 352.—When, and where, was the musket invented?

A.—About 1520, in Spain.

Q. 353.—Describe the musket.

A.—It was a fire-arm of larger calibre than either the hand-gun or harquebus, carrying a heavier ball, ten of which went to the pound.

Q. 354.—When was the musket introduced into England?

A.—About the middle of the sixteenth century.

Q. 355.—Where was the musket first extensively used?

A.—At the battle of Pavia in 1525.

Q. 356.—What is the meaning of the term musket, and to what fire-arm was the name applied?

A.—A fire-arm borne on the shoulder; the name was applied to the match-lock.

Q. 357.—What name was given to the wheel-lock in the sixteenth century?

A.—The fire-lock.

Q. 358.—When do we hear of the carabine or carbine being first used?

A. In 1559.

Q. 359.—What was the carbine, and why so called?

A.—A small fire-arm, about $3\frac{1}{2}$ feet long, and so called from a description of light cavalry denominated "carabins" who used them.

Q. 360.—What was the petronel?

A.—A medium between the harquebus and the pistol, having a broad butt to rest against the chest when about to be fired.

Q. 361.—To whom is the invention attributed, and where was it first used?

A.—To the French, and it was first used in the Pyrenees by banditti.

Q. 362.—What was the dragon?

A.—A small kind of blunderbuss, or short handgun of great bore, to carry a number of balls.

Q. 363.—Why was it so called?

A.—From its having a dragon's head at the muzzle.

Q. 364.—What was the caliver?

A.—A fire-arm with a bore of a fixed size, so that the common stock of bullets might fit every piece.

Q. 365.—What were the advantages of the caliver?

A.—It was of greater calibre than the harquebus, was lighter than the musket, was fired without a rest, and could be discharged more quickly than a musket.

Q. 366.—What important change did Queen Elizabeth make with regard to the arms of all footmen?

A.—By a proclamation, dated 1596, she directed their bows to be changed for muskets, and their bills into pikes.

Q. 367.—When, and where, was the snaphaunce invented?

A.—About 1590, in Germany.

Q. 368.—Describe the snaphaunce.

A.—The snaphaunce consisted of a piece of steel furrowed like the wheel of a wheel-lock set on a steel post, which moved on a pivot, and a cock in which was fixed a flint instead of a piece of pyrites; the priming pan was provided with a cover, which, when it was required to fire the arm, was pushed on one side, and the steel bent down over the pan; on the trigger being pressed the cock holding the flint fell on the steel, and forced it back from the pan, emitting at the same time sparks which fired the priming.

Q. 369.—Why was the snaphaunce so called?

A.—From its having been invented by a set of Dutch marauders called "snaphans."

Q. 370.—What were the three kinds of locks applied to the harquebus at different times?

A.—(1) The cock was fixed on the far side of the priming pan, and moved towards the firer.

(2) The cock was fixed between the priming pan and the firer, and moved from him.

(3) The cock was propelled forward by a snap.

Q. 371.—Into what two classes were the infantry divided when bows and arrows fell into disuse, and how were they armed?

A.—Musketeers, and pikemen; the former were armed with the match-lock musket, sword, and dagger, and the latter with the pike.

Q. 372.—How did the musketeer in England carry his powder in the time of James I.?

A.—In bandoliers.

Q. 373.—What was a bandolier?

A.—A bandolier consisted of a belt with twelve leather or tin cylindrical cases attached to it, each containing a charge; a bag was also attached to this belt to carry bullets.

Q. 374.—What was a 'touch box'?

A.—A flask containing a fine description of powder for priming.

Q. 375.—How was the bandolier carried?

A.—The bandolier was carried over the left shoulder.

Q. 376.—How was the musket and rest carried?

A.—The musket was carried on the left shoulder, and the rest in the right hand.

Q. 377.—What was the length of the barrel of the musket, and the size of the bore, in 1621?

A.—The barrel was 4 feet long, and the size of the bore 12, or 12 bullets to the pound.

Q. 378.—How was the cavalry soldier armed in the time of James I.?

A.—With the carbine, pistol, and sword.

Q. 379.—What was a 'tuck'?

A.—A thin rapier blade inclosed in the rest, which flew out when a spring was touched.

Q. 380.—What change did the musket rest undergo in the time of James I.?

A.—Instead of a wooden shaft it was made of a thin iron tube covered with leather, to contain the 'tuck.'

Q. 381.—When were rests said to contain Swedish or swine's feathers, and how were they used?

A.—When they contained the 'tuck' they were said to contain swine's feathers, and were used as a defence against cavalry.

Q. 382.—What other variety of the musket rest was there?

A.—One of the prongs of the rest was fitted with a spike.

Q. 383.—When, and by whom, were cartridges invented?

A.—By Gustavus Adolphus, King of Sweden (1611-1633).

Q. 384.—When do we first hear of the 'tricker-lock,' and what does it appear to imply?

A.—In 1629; it appears to imply the hair-trigger.

Q. 385.—To what fire-arms do we know that it was applied?

A.—To the wheel-lock, the match-lock, and the fire-lock.

Q. 386.—When was the flint-lock invented?

A.—About 1635.

Q. 387.—How did the flint-lock differ from the snaphaunce?

A.—By the cover of the pan forming part of the steel or hammer, which retained its furrows until the eighteenth century.

Q. 388.—What was the flint-lock generally called?

A.—The fire-lock.

Q. 389.—When did the musket rest fall into disuse?

A.—During Cromwell's protectorate.

Q. 390.—When, and where, was the bayonet invented?

A.—About 1646, at Bayonne.

Q. 391.—When were the swine's feathers laid aside?

A.—In the time of Charles II.

Q. 392.—When was the bayonet introduced into our army?

A.—In 1672.

Q. 393.—Of what did the bayonet at first consist?

A.—It consisted of a wooden handle, 8 or 9 inches long, to fix in the muzzle of the fire-lock, with a two-edged blade 1 foot in length, and a broad inch wide.

Q. 394.—Why was the invention of the bayonet considered a great improvement?

A.—Because it gave the fire-lock a second means of offence.

Q. 395.—In whose reign were bandoliers superseded by cartridge boxes?

A.—In the reign of Charles II.

Q. 396.—How did the introduction of cartridge boxes add to the efficiency of the soldier?

A.—By enabling him to load quicker.

Q. 397.—When were cartridge boxes introduced into England?

A.—About the same time as the flint-lock (1677).

Q. 398.—What were the advantages of the flint-lock over the match-lock?

A.—With the flint-lock the soldier was able to fire more rapidly, for "what makes the cock fall on the hammer, strikes the fire, and opens the pan at once;" whereas in the match-lock "you have to light and blow your match and open the pan before you can fire the piece." In the flint-lock, too, the priming is partially protected from the weather, while in the match-lock the pan "is made wide open." *

Q. 399.—When do we first hear of bayonets being fitted on to the muzzle of the musket by means of rings?

* See Text Book, § 160, p. 108.

A.—In 1796 the British 25th regiment, serving in the campaign in Flanders, was attacked by a French regiment having bayonets fitted in this manner.

Q. 400.—What was the immediate cause of the loss of the battle of Killiecrankie, in 1689?

A.—The difficulty of fixing bayonets, or of converting the fire-lock into a pike for close combat.

Q. 401.—What alteration was made in the bayonet shortly after the battle of Killiecrankie, and by whom?

A.—“Mackay ordered all his bayonets to be so formed that they might be screwed upon the barrel without stopping it up.”

Q. 402.—When did the socket bayonet come into general use?

A.—In 1703.

Q. 403.—By whom, and in what year, was the steel ramrod invented?

A.—By the Prince of Dessau in Prussia, about 1741.

Q. 404.—What did the steel ramrod replace?

A.—The scouring stick.

Q. 405.—What was the objection to the scouring stick?

A.—That it was very liable to be broken on service.

Q. 406.—When did soldiers of infantry cease to carry swords?

A.—In 1745 the men of battalion companies of infantry, and in 1746 of grenadier companies, ceased to carry swords.

Q. 407.—What were the arms of the infantry soldier confined to in the reign of George II.?

A.—To the musket and bayonet.

Q. 408.—What were the three methods, at different periods, of priming small arms?

A.—Originally the priming was put into the pan from a flask containing a fine-grained powder, called serpentine powder. In the early flint-lock musket a part of the powder passed through the vent into the

pan in loading. Latterly the top of the cartridge was bitten off, and the pan filled therefrom before loading.

Q. 409.—What were the objections to the flint-lock?

A.—That it did not entirely protect the priming from wet, and the flint sometimes failed to ignite the charge.

Q. 410.—By whom, and in what year, was fulminating powder invented?

A.—By Mr. Forsyth, in 1807.

Q. 411.—Of what ingredients was fulminating powder at first composed?

A.—Chlorate of potash, sulphur, and charcoal.

Q. 412.—What were the advantages of the percussion musket over the flint-lock?

A. The shooting was more accurate, the recoil was less, the rapidity of firing was greater, and the number of miss-fires were considerably reduced, being as 1 to 26 in favour of the percussion system.

Q. 413.—In what year was the flint-lock altered to suit the percussion system?

A.—In 1839.

Q. 414.—How was this alteration accomplished?

A.—By removing the hammer with the spring and pan, and replacing the cock by a conical-shaped hammer, with a hollow to fit on the nipple; this nipple consisted of a hollow pillar screwed into the side of the barrel, communicating with the vent or touch hole, to hold the copper cap containing the detonating composition.

Q. 415.—Of what was this detonating powder composed?

A.—Three parts of chlorate of potash, two of fulminate of mercury, and one of powdered glass.

Q. 416.—When was the percussion musket issued to the English army?

A.—In 1842.

Q. 417.—Why was the bore of the English musket,

being greater than that of any other foreign power, considered to be an advantage?

A.—Because we could fire their balls out of our barrels, whilst our balls could not be fired out of theirs.

Q. 418.—What were the ideas in 1846 as to the distance that musketry fire should be opened?

A.—Never beyond 150 yards, except under peculiar circumstances, “such as when it may be desirable to bring a fire on field artillery,” when fire may be opened at 400 yards.

Q. 419.—How long did the percussion musket continue in use in our army?

A.—Until partially superseded by the Minié rifle in 1851, and altogether by the Enfield rifle in 1855.

RIFLES.

Q. 420.—To whom has the invention of rifling been attributed?

A.—To Gaspard Zoller, of Vienna.

Q. 421.—In what year was rifling invented?

A.—In 1498.

Q. 422.—How were the grooves first cut?

A.—Straight down the bore.

Q. 423.—For what purpose is it supposed that grooves were first cut down the bore?

A.—In order to decrease the fouling.

Q. 424.—Why did this method of cutting grooves down the bore increase the accuracy of the shooting?

A.—Because the bullet was directed in a straight line down the barrel.

Q. 425.—When, and by whom, was the spiral form of grooving invented?

A.—In 1520, by Koster of Nuremberg.

Q. 426.—Does it appear certain why the spiral form of grooving was introduced?

A.—No; there is some doubt as to whether it was

adopted for its real value, or whether only from fancy.

Q. 427.—For what were rifles at first used?

A.—For amusement.

Q. 428.—When were rifles first employed in warfare?

A.—In the middle of the seventeenth century.

Q. 429.—In what year were rifled carbines first issued to the cavalry?

A.—In 1680 eight were supplied to each troop of Life Guards.

Q. 430.—What rifle was issued to the 95th Regiment in 1800?

A.—Baker's rifle.

Q. 431.—Describe Baker's rifle.

A.—Baker's rifle weighed $9\frac{1}{2}$ lbs.; the barrel was $2\frac{1}{2}$ feet long; it had seven grooves, making a quarter turn in the length of the barrel, and its calibre was 20 bore.

Q. 432.—How was the ball made to enter the barrel?

A.—By means of a small wooden mallet issued with the rifle.

Q. 433.—What was the great objection to Baker's rifle?

A.—The difficulty experienced in loading it.

Q. 434.—How did M. Delvigne propose to remedy this evil?

A.—He proposed to place a chamber at the bottom of the breech, having an abrupt connection with the bore; the charge of powder nearly filled this chamber, and the bullet, which fitted the barrel loosely, rested upon it and was forced into the grooves by ramming.

Q. 435.—What were the objections to Delvigne's principle?

A.—That the hard ramming necessary to load the rifle injured the powder as well as the ball.

Q. 436.—Was this principle of Delvigne's ever adopted?

A.—No.

Q. 437.—When, and by whom, was the tige rifle invented?

A.—By Colonel Thouvenin, in 1828.

Q. 438.—Describe the tige principle.

A.—It consisted of a small steel pin fixed in the bottom of the bore, around which the powder lay, and on which the ball rested when the rifle was loaded.

Q. 439.—Why was the tige rifle not adopted at this time?

A.—Because it was found that the ball was propelled with diminished force owing to its receiving the impulse of the charge obliquely.

Q. 440.—How did Colonel Poncharra propose to remedy the defects of the Delvigne principle?

A.—He suggested placing a wooden sabot underneath the ball, which rested on the offsets of the chamber, and thereby prevented the ball from entering it and injuring the powder.

Q. 441.—Why was this Delvigne-Poncharra rifle not adopted?

A.—On account of the complicated nature of the ammunition, and the difficulty of procuring it in the field, besides which the sabots frequently broke in loading.

Q. 442.—Who suggested cylindro-conical bullets?

A.—M. Delvigne.

Q. 443.—What rifle was introduced into the army in the reign of William IV.?

A.—The Brunswick rifle.

Q. 444.—Describe the Brunswick rifle.

A.—This rifle had a back-action hook lock, its weight, with bayonet and scabbard, was 11 lbs. 5½ oz., the length of the barrel was 2½ feet, and it had two grooves making one turn in the length of the barrel.

Q. 445.—What were the objections to the Brunswick rifle?

A. The difficulty of loading it, owing to the ball having a belt round it, with a patch to prevent its “stripping;” this belted ball had to be placed properly

in the grooves, or otherwise loading was impossible; the rifle, too, soon fouled, and its shooting beyond 400 yards was erratic.

Q. 446.—In what year, and by whom, was the first suggestion of the principle of expansion advanced?

A.—In 1836, by Mr. Greener.

Q. 447.—Describe Mr. Greener's bullet.

A.—It was an oval shaped bullet, having an opening at one end to receive a "taper plug, with a head like a round-topped button, of a composition of lead, tin, and zinc"; on the explosion of the powder this plug, which was larger at the head than the opening in the bullet, was driven home, when the sides of the bullet were dilated and forced into the grooves.

Q. 448.—Why was Mr. Greener's invention rejected?

A.—On the ground of the bullet being a compound.

Q. 449.—Who discovered that elongated bullets, hollowed at the base, were expanded and forced into the grooves by the explosion of the powder?

A.—M. Delvigne, in 1841.

Q. 450.—What improvement did the tige rifle undergo in 1844?

A.—The tige or stem was made longer, so as to allow a space for the fouling accumulating from fifty rounds; the rifle was thus tried with Delvigne's elongated bullet, and was adopted in France as the arm of the Chasseurs.

Q. 451.—What was the objection to the tige rifle?

A.—It was difficult to clean, a special instrument being necessary for the purpose.

Q. 452.—What is the Minié principle?

A.—An iron cup placed in a cavity at the base of the bullet, by which it is expanded on the explosion of the powder.

Q. 453.—What is the Minié rifle?

A.—An ordinary rifle carrying a Minié bullet.

Q. 454.—What caused the manufacture of the tige rifle to be discontinued?

A.—The introduction of the Minié rifle.

Q. 455.—What did Captain Tamisier discover was necessary in order to increase the precision of elongated bullets?

A.—That it was necessary to ascertain the means of giving them a point of resistance as far as possible behind their centre of gravity.

Q. 456.—What are cannelures?

A.—Grooves cut round the base or posterior end of the bullet.

Q. 457.—What is the object of cannelures?

A.—To rectify the path of the bullet, by creating, through their agency, resistances which should act when the axis of the bullet does not coincide with the direction of motion.

Q. 458.—What did Tamisier find he was compelled to do in order to have the centre of gravity of his bullet far forward?

A.—That it was necessary to flatten the front of the bullet.

Q. 459.—How would the centre of gravity, being near the base of the bullet, affect its flight?

A.—The rear end would have a tendency to fall before the front.

Q. 460.—How might its flight in this case be rectified?

A.—By means of cannelures.

Q. 461.—When was the Minié rifle introduced into the English army?

A.—In 1851.

Q. 462.—Was it ever generally issued?

A.—No.

Q. 463.—Where was the Minié rifle used by our troops?

A.—In the Caffre war in 1851, and also in the Crimea at the battles of the Alma and Inkerman.

Q. 464.—Describe the Minié rifle.

A.—The weight of this rifle, with bayonet, was 10 lbs. 8½ ozs.; the length of the barrel was 3 ft. 3 in., and it had four grooves making one turn in 78 inches, the diameter of the bore was .702.

Q. 465.—What form of bullet was first used with the English Minié rifle?

A.—Conoidal.

Q. 466.—Why was this form defective, and by what was it replaced?

A.—It was defective owing to there being little chance of the axis of the bullet coinciding with the axis of the barrel during its passage out; it was therefore changed to a cylindro-conoidal form, with a hemispherical iron cup.

Q. 467.—What was the peculiarity of the cartridges in which these bullets were made up?

A.—That they had to be reversed by the hand (after pouring the powder into the barrel), to insert the bullet.

Q. 468.—Describe the Enfield rifle.

A.—The weight of this rifle, with bayonet, was 9 lbs. 3 ozs.; the length of the barrel was 3 ft. 3 in., and it had three grooves making one turn in 78 inches, the diameter of the bore was .577.

Q. 469.—What was the form and weight of the bullet for the Enfield rifle, and what was it called?

A.—It was cylindro-conoidal in form, its weight was 530 grains, and it was known as the Pritchett bullet.

Q. 470.—What was the result of the trial in 1853 between the Enfield rifle, the Minié rifle musket, and Lancaster's smooth-bore elliptical rifle?

A.—In favour of the Lancaster.

Q. 471.—In what year was the Enfield rifle introduced into the English army?

A.—In 1855.

Q. 472.—How long did the Enfield rifle continue in use?

A.—Until the introduction of breech-loaders.

Q. 473.—What rifle was issued to the Sappers and Miners in 1855?

A.—The Lancaster smooth-bore elliptical rifle.

Q. 474.—What were the several improvements made in the Enfield rifle after its first appearance?

A.—In 1854 a new back sight was fitted to the rifle, which combined Messrs. Richards and Lancaster's principles with that of the Ordnance pattern 1851 fitted to the Minié rifle.

In 1855 a new ramrod with a jagged head was adopted.

In 1858 the grooves, which were at first of uniform depth, were made progressive.

In 1860 all the parts of the lock and rifle were made interchangeable.

Q. 475.—What are the several peculiarities in Mr. Westley Richards' back sight, in that of Mr. Lancaster's, and in that of the Ordnance pattern of 1851?

A.—In Mr. Westley Richards' sight the flap can be put down on the barrel from or towards the muzzle; in Mr. Lancaster's, the flap is protected by flanges; and in the Ordnance pattern the flap is kept in a perpendicular position by a spring.

Q. 476.—What rifle was issued to the Royal Navy, the Rifle Brigade, and to sergeants of infantry in 1858?

A.—A short Enfield .577 inch in diameter of bore, and having five progressive grooves with one turn in 4 feet.

Q. 477.—What system was adopted by Mr. Whitworth in 1854?

A.—That system in which "the interior of the barrel is hexagonal," and which, "instead of consisting partly of non-effective lands, and partly of grooves, consists of effective rifling surfaces. The angular corners of the hexagon are always rounded."

Q. 478.—What amount of spirality, and what size bore did Mr. Whitworth consider best for a military barrel 39 inches long?

A.—Grooves making one turn in 20 inches, and a .45-inch bore.

Q. 479.—What two different bullets may be used with the hexagonal bore?

A.—Either cylindrical or hexagonal bullets.

Q. 480.—Explain why cylindrical bullets can be

used with equal effect as hexagonal bullets with this form of rifle barrel?

A.—“Supposing a bullet of a cylindrical shape to be fired, when it begins to expand it is driven into the recesses of the hexagon. It thus adapts itself to the curves of the spiral, and the inclined sides of the hexagon offering no direct resistance, expansion is easily effected.”

Q. 481.—What are the advantages of the hexagonal system over the ordinary grooved rifle?

A.—“While the ordinary grooved rifle depends upon the expansion of the soft metal projectile, in the hexagonal system rifling may be effected independently of expansion, by making the projectile of the same shape as the interior of the barrel, in other words, by having a mechanical fit between them. The projectile may be used naked, and be made of metal of any degree of hardness.”

Q. 482.—When was the Enfield rifle converted into the breech-loading Snider, and when was it issued?

A.—In 1866.

Q. 483.—How did the new Snider arms differ from the converted Enfields?

A.—In the new Sniders, steel was used for the barrel instead of iron, and a locking bolt was added to the breech block.

Q. 484.—When was the Martini - Henry rifle adopted?

A.—In 1871.

Q. 485.—Describe the breech action of the Martini-Henry rifle?

A.—The breech is closed by a block which swings on a pin passing through the upper rear end of the shoe. This block is acted on by a lever. The action of pushing the lever forward causes the block to fall, the tumbler to be carried round until the trigger nose drops into the tumbler bent, the mainspring to be compressed, and the empty cartridge case to be thrown out to the rear. The cartridge is exploded by a

direct-acting piston, which is driven by the action of a strong spiral spring within the breech block.

Q. 486.—What parts of the lock and rifle are made of steel?

A.—The barrel, body, extractor, tumbler, trigger, trigger spring, spiral spring, striker, cleaning rod, and all the screws.

Q. 487.—What parts are of iron?

A.—The lever, block, trigger guard, bands, butt, plate, and stockbolt.

Q. 488.—How is the barrel rifled?

A.—With seven grooves, 0·03 inch of the original bore being left between the adjacent grooves as lands.

Q. 489.—What amount of twist is given to these grooves?

A.—One turn in 22 inches, or $1\frac{1}{2}$ times in the length of the bore.

Q. 490.—What is the weight of the rifle without the bayonet?

A.—8 lbs. 12 ozs.

Q. 491.—What is the weight of the charge and the bullet, and what is the shape of the cartridge?

A.—Powder charge weighs 85 grs., and the bullet 480 grs., the cartridge is bottle-shaped.

Q. 492.—What is the length of the rifle?

A.—4 feet $1\frac{1}{2}$ inches.

Q. 493.—What is the calibre?

A.—·45 inch.

Q. 494.—Up to what distance is the rifle sighted?

A.—To 1400 yards.

Q. 495.—Between what period did fire-arms undergo little real improvement or alteration?

A.—After the appearance of the flint-lock, in 1635, until towards the middle of the present century.

RIFLING.

Q. 496.—For what purpose are fire-arms rifled?

A.—“To give rotation to the projectile round its axis of progression in order to insure a regular and steady flight.”

Q. 497.—Under what three headings may the systems of rifling in general use be classified?

A.—(1) The grooved cylinder.

(2) The elliptical or oval bore.

(3) The polygonal system.

Q. 498.—What is the grooved cylinder system?

A.—It is a system that has been adopted since the first introduction of rifled arms, and is that which was adopted at Enfield, until the introduction of the Martini-Henry.

Q. 499.—What is the distinctive character of the elliptical or oval bore?

A.—The barrel is cut in its interior in the form of an ellipse.

Q. 500.—What are the advantages of this system?

A.—The barrel is a smooth bore, and therefore easily cleaned, there are no recesses for the collection of fouling, and the bullet does not act upon the air with any sharp edges.

Q. 501.—By whom has the polygonal system been adopted?

A.—By Mr. Henry, the bore of whose rifle is heptagonal, with a rib in each of the angles. By Mr. Westley Richards in his breech-loader, the bore of which is octagonal; and by Mr. Whitworth in his rifle, the bore being in this case hexagonal.

Q. 502.—What are the various forms of grooving?

A.—Round, angular, and circular.

Q. 503.—What are the several varieties, as regards depth of grooving, that have been in use at different times?

A.—In early rifles the grooves were very deep and

uniform ; in those of more modern date, the grooves are shallower and uniform ; lately they have been made progressive.

Q. 504.—What number of grooves, at least, must a rifle have, and why ?

A.—Two ; one only would cause error.

Q. 505.—What do you understand by the terms ‘pitch of the rifling’ and ‘spirality’ ?

A.—The twist in the grooving.

Q. 506.—Under what three heads may this twist be classified ?

A.—Uniform, gaining, and decreasing.

Q. 507.—Distinguish between the uniform, gaining, and decreasing twist.

A.—The uniform twist is that which makes an equal number of turns in equal distances.

The gaining twist is that which increases towards the muzzle.

The decreasing twist that which decreases towards the muzzle.

Q. 508.—What are the defects of the gaining and decreasing twist ?

A.—That the bullet in its passage down the bore has to alter its shape in order to make its way out, it is therefore never, from the instant it is put in motion, at any two spots of the same form ; the increased resistance, thus experienced, causes loss of power, loss of initial velocity, and consequently loss of rotation.

Q. 509.—What do you understand by progressive grooves ?

A.—Those grooves that increase in depth from muzzle to breech.

Q. 510.—When is the pitch of the rifling said to be the same in two rifles of different diameters ?

A.—When the angle formed by the grooves and the circumference of the bore are equal.

MUSKETRY INSTRUCTION.

PART I.

Q. 1.—Under whose responsibility is the musketry instruction of the troops placed?

A.—“Under the responsibility of commanding officers.”

Q. 2.—How are commanding officers to make themselves acquainted with the theory and practice of musketry?

A.—(1) “By careful study of the regulations.”

(2) “By giving their personal superintendence to the companies under instruction.”

(3) “By availing themselves of the assistance and information to be derived from inspectors of musketry, at their periodical visits.”

Q. 3.—Who is to conduct the correspondence on the subject?

A.—The commanding officers, and not the musketry instructors.

Q. 4.—Who is responsible for the accuracy of the returns?

A.—The commanding officer, “who is to afford every information and explanation which may be called for by the Inspector-general of musketry.”

Q. 5.—To whom are commanding officers to apply if they are in doubt as to any point in the regulations, or deem it necessary to make any exception thereto?

A.—To the inspector of musketry.

Q. 6.—What are the duties of the majors?

A.—(1) “They are to render themselves acquainted with the theory and practice of musketry.”

- (2) "Frequently to visit the men engaged at drill and practice, to see that the instructions and orders referring thereto are observed."

Q. 7.—If there is only one major present with the battalion who is to take this duty in turn with him?

A.—The senior captain.

Q. 8.—What are the duties of captains and sub-alterns?

A.—(1) "They are to make themselves equally conversant with the musketry instruction as with the company and battalion drill, of which it is a component part."

(2) "They are to be present at the musketry drill and practice of their companies."

(3) "They are to acquaint themselves with the proficiency of every man thereof in shooting, and judging distance."

Q. 9.—May the company officers take part in the preliminary drills and the individual firing?

A.—Yes, they are to be encouraged to do so.

Q. 10.—Under what conditions?

A.—That their points are not included in the figure of merit.

Q. 11.—How are all young officers to execute their musketry training?

A.—They "are to be put through the entire course as for recruits."

Q. 12.—What are the duties of the officer-instructor?

A.—(1) "He is charged with the entire musketry training of the young officers and recruits."

(2) "With the preliminary drills of the non-commissioned officers of the battalion annually."

(3) "He is responsible to the commanding officer that the target and judging distance practices are conducted with uniformity by the several companies, and in strict accordance with the regulations."

(4) He will act as umpire in the case of disputed hits.

Q. 13.—Is he to be exempt from all regimental and garrison duties?

A.—Yes.

Q. 14.—When is he liable to be called upon to perform regimental and garrison duties?

A.—“When he is prevented from carrying on those of his special appointment.” When the course is suspended in the summer, or when he is present with his regiment during the winter.

Q. 15.—Whose sanction is it necessary to obtain previous to the officer-instructor being employed in regimental or garrison duties?

A.—“The general officer commanding on the spot.”

Q. 16.—Where is his having been so employed to be notified?

A.—In the monthly musketry diary.

Q. 17.—What allowance of leave is granted to the officer-instructor?

A.—“The usual winter leave of two months and a half, when the annual course has terminated.”

Q. 18.—What is it absolutely necessary for every officer-instructor to possess?

A.—A first-class certificate from the school of musketry.

Q. 19.—Who is the assistant officer-instructor?

A.—“In every battalion a subaltern is to be appointed to act as assistant officer-instructor, who is to be exempt from all regimental and garrison duties while the annual course is proceeding.”

Q. 20.—What certificate should he be in possession of?

A.—A certificate of qualification from the school of musketry.

Q. 21.—Should leave of absence be granted to the instructor and assistant-instructor at the same time?

A.—“Except in very urgent cases leave of absence is not to be recommended for the instructor and

assistant-instructor at the same time; nor when the annual course is proceeding; nor when there is any considerable number of recruits to be trained."

Q. 22.—When is the allowance of pay to be granted to the assistant-instructor?

A.—"When the instructor is absent for upwards of fourteen days, the allowance for the whole period is to be issued to the assistant-instructor."

Q. 23.—Where are the words "gazetted instructor," "provisional instructor," or "assistant-instructor in musketry" to be entered?

A.—"They are to be inserted against the names of the officers so employed in the musketry diary and annual practice returns, and in the monthly regimental returns."

Q. 24.—To whom does the Commander-in-Chief look for the carrying out of the system detailed in the regulations?

A.—To commanding officers.

Q. 25.—Who is responsible for the due training of both officers and men in their various duties?

A.—Commanding officers.

Q. 26.—What then is the duty of the commanding officer?

A.—To report to the Commander-in-Chief all who, by neglecting to attain a thorough knowledge of their duties, disqualify themselves for their position as instructors, or as company officers.

Q. 27.—What is the necessary qualification for a sergeant to become a sergeant-instructor in musketry?

A.—He "must have undergone a course of instruction at the school of musketry, and have obtained a certificate of qualification."

Q. 28.—What are the duties of the sergeant-instructor?

A.—(1) "To assist the officer-instructor in all his duties."

(2) "To attend the target and judging distance drills and practices."

(3) "To superintend the company-instructors."

Q. 29.—For what purpose is he to be exclusively employed?

A.—“In the musketry training of the men of the battalion.”

Q. 30.—When is he liable to be called on to perform regimental, garrison, or barrack duties?

A.—“When not actually required for the performance of the duties appertaining to his appointment.”

Q. 31.—How may he be employed?

A.—“In any manner suitable to his rank as a staff-sergeant, at the discretion of his commanding officer.”

Q. 32.—How is he never to be employed?

A.—“As canteen sergeant, or accountant, or steward, or caterer, or treasurer to the sergeants’ mess.”

Q. 33.—Is he subject to the orders of any non-commissioned officer?

A.—Only as regards discipline.

Q. 34.—Who is the company-instructor?

A.—The colour-sergeant, or troop sergeant-major.

Q. 35.—What are the duties of the company-instructor?

A.—(1) “He is to attend with his company when under instruction.”

(2) “To assist the officer and sergeant-instructor in their duties.”

(3) “To see that the men keep up the instruction they have received in the cleaning and management of their arms.”

Q. 36.—What are the duties of the non-commissioned officers of a battalion?

A.—“They are to assist as ‘drills’ in the instruction of the men of their respective companies.”

Q. 37.—Who is responsible that a sufficient number of trained captains and subalterns is always available to fill the vacancies for instructors that may occur?

A.—The commanding officer.

Q. 38.—What is the strength of a party proceeding to Hythe?

A.—One officer, two sergeants, two corporals, and three privates, including the officer's servant.

Q. 39.—May lance corporals be sent in lieu of either full corporals or privates?

A.—No.

Q. 40.—What is the qualification, as to length of service, necessary.

A.—“No men are to be selected who are under eighteen months' or over nineteen years' service.”

Q. 41.—What is the object of sending men to the school of musketry?

A.—“Solely to qualify them to render valuable assistance in the rifle training of their regiments.”

Q. 42.—What men should therefore only be selected with a view to such end being attained?

A.—“Only those soldiers who are likely, from their quickness, intelligence, and good conduct, to make good non-commissioned officers, and be of use to their regiments, are to be detached for training thereto.”

Q. 43.—How are parties to proceed to Hythe?

A.—Fully armed and equipped, but without ammunition.

Q. 44.—What is to be done previous to the party proceeding to Hythe?

A.—They are all to be medically inspected, and reported fit for duty.

Q. 45.—When is this medical inspection to be made?

A.—On the day of their leaving head-quarters.

Q. 46.—What documents is the officer in charge of the party to take with him?

A.—“The men's company and regimental defaulter sheets, together with form M. showing the extent to which they have been exercised in the current annual course.”

Q. 47.—By whom are applications to attend the school of musketry to be recommended?

A.—“By the commanding officers of regiments or depôts.”

Q. 48.—When should these applications be sent in if the applicants be on leave of absence from foreign stations?

A.—“In sufficient time to enable them to go through the course, and join their corps at the expiration of their original leave.”

Q. 49.—Is an officer allowed to return to Hythe a second time?

A.—No.

Q. 50.—Is there any exception to this?

A.—Yes; in the case of an officer who had been prevented from completing the course the first time by illness.

PART II.

INSTRUCTION OF THE RECRUIT.

Q. 51.—Into what two parts is the instruction of musketry divided?

A.—Into ‘Preliminary Drill’ and ‘Practice.’

Q. 52.—What subjects are comprised under the head of preliminary drill?

A.—(1) Cleaning arms.
 (2) Theoretical principles.
 (3) Aiming drill.
 (4) Position drill.
 (5) Blank firing.
 (6) Judging distance drill.

Q. 53.—What subjects are comprised under the head of practice?

A.—

(1) Ball practice	{	Firing singly.
		Firing by volleys.
		Independent firing.
		Firing in skirmishing order.
(2) Judging distance practice.		

Q. 54.—Under whom is the recruit to be on first joining, and for how long?

A.—“Under the adjutant and gymnastic instructor for at least two months.”

Q. 55.—To whom is the recruit then handed over, and for what purpose?

A.—To the officer-instructor of musketry, for the purpose of being put through a course of rifle training according to the prescribed detail.

Q. 56.—How long should this course take?

A.—Three weeks, weather permitting.

Q. 57.—How is the recruit's time employed during the eight days' preliminary drill?

A.—

Days.	Cleaning Arms.	Theoretical Principles.	AIMING DRILL.		Position Drill.	Blank Firing.	JUDGING DISTANCE DRILL.	
			No.	Distances aimed at each Drill.			No.	Description.
1st	1	—	1	Explain rules, and aim at 100 and 150 yds.	2	—	1	Known and unknown distances to 300 yds.
2nd	—	1	1	200, 250, and 300 yds.	2	—	1	Ditto
3rd	1	—	1	350, 400, and 450 yds.	2	—	1	Ditto
4th	—	1	1	500, 550, and 600 yds.	2	—	1	Ditto
5th	1	—	1	650, 700, and 750 yds.	2	—	1	Known and unknown distances to 600 yds.
6th	—	1	1	800, 850, and 900 yds.	2	—	1	Ditto
7th	1	—		— — —	2	20 rounds	1	Ditto
8th	—	1		— — —	2	20 rounds	1	Ditto

Q. 58.—What is the minimum number of lessons and drills through which the recruit is to be exercised before he is allowed to fire ball?

A. —Cleaning Arms,	Theoretical Principles,	Aiming Drill,	Position Drill,
4	4	6	16

Blank Firing,
40 rounds,

Judging Distance Drill,
8

Q. 59.—What is to be the duration of each lesson in cleaning arms and theoretical principles, and each position drill?

A.—Half an hour.

Q. 60.—How are the men at aiming drill to be exercised when not actually engaged in aiming?

A.—“They are to be exercised in position drill, with the sight adjusted for the actual distance from the target.”

Q. 61.—How are recruits of corps armed with rifles sighted only to 300 yards to execute their aiming drill?

A.—“They are to aim at one distance a day, repeating the same at 300 yards on the sixth day.”

Q. 62.—For what purpose are wet days to be taken advantage of?

A.—“To ascertain the proficiency of the men in each lesson.

Q. 63.—What should be done when a recruit, after being put through a lesson once, is found not to have a competent knowledge of it; or, after having been exercised through the whole number, is found unfit to proceed to practice?

A.—“He is to be put back to another squad to commence again.”

Q. 64.—At how many distances may the recruit fire each day?

A.—“At not more than one distance.”

Q. 65.—May the recruit execute more than one practice in judging distance in a day?

A.—No.

Q. 66.—When may a recruit be put back to commence his target practice again?

A.—“At any time before he has completed his first ten rounds.”

Q. 67.—What further course is he, with the approval of the commanding officer, to be put through?

A.—“A further course of aiming and position drills, and blank firing.”

Q. 68.—Are the points he obtained up to the time his firing was suspended to be considered?

A.—No; “they are to be cancelled, and scored out in the register.”

Q. 69.—Where is the cause of the points being cancelled to be stated?

A.—“In the column ‘Total Points.’”

Q. 70.—When are recruits thus put back for further drill to complete their judging distance practice?

A.—“With the squad they originally commenced with.”

Q. 71.—For what purpose is the rifle placed in the soldier’s hands?

A.—“For the destruction of his enemy.”

Q. 72.—What should be impressed upon the mind of the soldier with regard to the use of the rifle?

A.—“That his own safety depends upon its efficient use, and that every man who has no defect in his sight may be made a good shot; also that no degree of perfection he may have attained in the other parts of his drill can upon service remedy any want of proficiency in this.”

Q. 73.—What is the aim and object of all his other instruction in marching and manœuvring?

A.—“To place him in the best possible situation for using his weapon with effect.”

Q. 74.—What is to be the strength of a squad undergoing instruction when the recruits of a battalion number over sixty?

A.—A squad of not less than twenty men.

Q. 75.—What is to be the strength of the squad when the recruits number under sixty?

A.—Not less than ten.

Q. 76.—May a recruit join the service companies of his regiment before he has completed a course of rifle training?

A.—No, “unless by special authority from the Adjutant-General to the Forces.”

Q. 77.—What is to be stated in applying for this authority?

A.—“The reason for making it, and the date on which the recruit joined.”

Q. 78.—May a recruit, after having been trained as such, be exercised as a drilled soldier of the company to which he belongs during the current year’s course of musketry?

A.—Yes; “but all the preliminary drills prescribed for the drilled soldier must be executed previously to commencing the practice.”

PART III.

ANNUAL COURSE FOR THE TRAINED SOLDIER.

Q. 79.—What is the soldier considered to have acquired by the course of instruction he was put through as a recruit?

A.—(1) “A knowledge of the theory of musketry.”
 (2) “The rules for keeping his rifle in order.”
 (3) How to become a “fair average shot.”
 (4) “Habits of thought and observation.”

Q. 80.—What is the object of the annual course for the trained soldier?

A.—“To ensure the knowledge previously acquired being perfected and maintained by a modified system of preliminary drill before the yearly allowance of practice ammunition is expended.”

Q. 81.—When is the course to commence in the infantry at home?

A.—“On the 1st April.”

Q. 82.—When is it to commence in the infantry abroad?

A.—“On the 1st October, or the beginning of the cool season.”

Q. 83.—When is the course to commence in the cavalry at home?

A.—“On the 1st September, unless otherwise directed by instructions from the Adjutant-General to the Forces.”

Q. 84.—Why are these regulations as to the commencement of the course to be strictly observed?

A.—“To establish uniformity of proceeding, and to ensure the instruction being carried out in the shortest time.”

Q. 85.—Why are general officers to see that the course is proceeded with regularly, and without interruption?

A.—“In order that the same may be got through by all corps in the prescribed period, and that the annual practice returns may be rendered at the appointed time.”

Q. 86.—How and when are the non-commissioned officers to be exercised through the prescribed drills?

A.—By one-fourth at a time, previous to the commencement of the annual course.

Q. 87.—By whom are they put through these preliminary drills?

A.—“By the officer and sergeant-instructors.”

Q. 88.—Under whose superintendence are these drills to be executed?

A.—“Under the superintendence of a regimental field officer.”

Q. 89.—Are the non-commissioned officers to be struck off duty while thus employed?

A.—Yes.

Q. 90.—How are they to be put through these drills when it is impossible, owing to the severity of the duties, to detail one-fourth at a time?

A.—Then one-eighth of the number is to be handed over.

Q. 91.—What arrangements are to be made when one-eighth of the non-commissioned officers only can be exercised at a time?

A.—“Such arrangements as shall prevent the commencement of the instruction of the companies or troops being delayed beyond the dates specified.”

Q. 92.—May the preliminary drills of the non-commissioned officers ever be dispensed with?

A.—No, “never under any circumstances.”

Q. 93.—How long will these preliminary drills take?

A.—Four days per squad.

Q. 94.—How are the non-commissioned officers to be employed after they have been exercised through their preliminary drills?

A.—“To assist in the instruction of their respective companies.”

Q. 95.—How are the companies struck off duty for the purpose of going through the annual course?

A.—“In succession, with their officers and non-commissioned officers.”

Q. 96.—Under whose superintendence is a company exercised through the annual course?

A.—Under the superintendence of its captain.

Q. 97.—For what purpose are the officer and sergeant-instructors to be present?

A.—To assist.

Q. 98.—How long will the preliminary drills of a company take?

A.—Four days.

Q. 99.—How many aiming drills, position drills, and judging distance drills will be executed each day?

A.—One aiming drill, two position drills, and one judging distance drill.

Q. 100.—What should be the duration of each of the above drills?

A.—Each aiming and judging distance drill should occupy one hour, and each position drill half an hour.

Q. 101.—At how many distances is the drilled soldier to aim each day?

A.—Three.

Q. 102.—At what distances is he to aim each day?

A.—Any three distances, at the discretion of the officer commanding the parade.

Q. 103.—Up to what distance is the drilled soldier to judge on the first day of the preliminary drills?

A.—Up to 500 yards.

Q. 104.—Up to what distance is he to judge on the three remaining days?

A.—Any distance, at the discretion of the officer commanding the parade.

Q. 105.—How are the men to be employed at aiming drill, when not actually engaged in aiming?

A.—“In ‘Position Drill,’ with the sight for the actual distance.”

Q. 106.—At how many distances will men armed with rifles sighted to 300 yards aim daily?

A.—At one distance daily.

Q. 107.—At how many distances will men armed with rifles sighted to 600 yards aim daily?

A.—At two distances.

Q. 108.—Who may be exempted from the above aiming and position drills?

A.—First-class shots, provided they continue efficient.

Q. 109.—Who may be exempted from the judging distance drills?

A.—First-class judges of distance, provided they continue efficient.

Q. 110.—Whose leave will it be necessary to obtain before these men are exempted from the above drills?

A.—The commanding officer's.

Q. 111.—At what distances are short-sighted men to aim?

A.—Only at distances according to their powers of vision.

Q. 112.—What will a company proceed immediately to execute, when it has finished the preliminary drills?

A.—“The three classes of individual firing, the volley, independent, and skirmishing practices, and the three periods of the judging distance practice.”

Q. 113.—How long should this occupy?

A.—“At the utmost eight days.”

Q. 114.—At how many distances is each man to fire daily?

A.—At one distance.

Q. 115.—At how many distances may each man fire daily?

A.—Two distances, but never more than twenty rounds is to be fired in a day.

Q. 116.—How many practices in judging distance drill is each man daily to execute?

A.—One practice.

Q. 117.—May more than one practice in judging distance drill ever be executed?

A.—Yes, “when the commanding officer deems it advisable, a whole class of judging distance practice may be executed.”

Q. 118.—How many days will it take to execute the volley, independent, and skirmishing practices?

A.—Two days.

Q. 119.—Which of the above practices are to be executed in one day?

A.—The volley and independent practices.

Q. 120.—What part of the target practice is the captain of the company personally to superintend?

A.—“The volley, independent, and skirmishing practices, and the firing in the 1st class.”

Q. 121.—When is the officer-instructor to be present?

A.—“During the shooting in the 2nd and 3rd classes.”

Q. 122.—When is the assistant officer-instructor to be present?

A.—“During the 1st class firing and remaining practices.”

Q. 123.—When is another company to be struck off duty to be exercised in the preliminary drills?

A.—“When the company at practice has fired to the end of the 2nd class.”

Q. 124.—In what cases is only one company to be struck off duty at a time for instruction?

A.—In brigade depôts, and when the men have only three nights in bed.

Q. 125.—During what months may the annual course be suspended for continuous battalion, brigade, and division drills?

A.—During the months of June, July, and August.

Q. 126.—By whose order may the annual course be suspended for this purpose?

A.—By the order of the general commanding the division or district.

Q. 127.—When is the course to be resumed?

A.—“On the 1st September; but only on those days on which there are no brigade or divisional days.”

Q. 128.—To whom does this rule not apply?

A.—“To recruits, or to battalions abroad.”

Q. 129.—On what day in each week may the instruction be suspended abroad?

A.—On Wednesday.

Q. 130.—Should the weather not prove fine on the Wednesday, may the instruction be suspended on any other day instead?

A.—No.

Q. 131.—During what months is no shooting to take place in the United Kingdom?

A.—“During the months of December, January, and February, except under special circumstances.”

Q. 132.—During what seasons of the year should the annual course be completed?

A.—“During the summer and autumn.”

Q. 133.—To whom is the circumstance to be reported when the annual course is suspended?

A.—To the Adjutant-General, for the information of the Commander-in-Chief.

Q. 134.—What is to be forwarded with the report

when the suspension is owing to the troops having only three nights in bed?

A.—“Correct duty states, specifying the posts of sentries, and the numbers furnished for guard.”

Q. 135.—How are brigade depôts to proceed with the annual course?

A.—“In the same manner as detailed for other battalions; but only one company from a depôt is to be under instruction at the same time.”

Q. 136.—By whom will the instruction of the drilled soldiers be conducted?

A.—“By an officer and sergeant temporarily detailed for the duty.”

Q. 137.—Are they entitled to any extra pay for this duty?

A.—Yes, they will receive extra-duty pay for the actual number of days they are employed on this duty.

Q. 138.—When will a company detached from head-quarters to a station where there is no range go through its annual course?

A.—“When it can be relieved by a company that has previously gone through the year’s practice.”

Q. 139.—When will a detached company go through its course, when there is a range available at the detachment?

A.—“After those at head-quarters have completed their course of drill and practice.”

Q. 140.—Why is a company to be as complete as possible when handed over for instruction?

A.—“To prevent the delay and inconvenience arising from casualties.”

Q. 141.—When are men who have been prevented, owing to their being in prison, in hospital, or on command, from attending with their companies for rifle instruction, to be exercised?

A.—As soon as they are available they are to be exercised with the company next furnished for instruction.

Q. 142.—Will their performances be recorded in

the same registers and summaries as the company to which they are attached for training?

A.—No; they will be recorded in separate registers and summaries.

Q. 143.—When are those men who were not available when the companies of their battalion were being exercised, to be put through a course of rifle training?

A.—“If five in number, they are to be taken through a course of preliminary drills and practice in a squad by themselves, before the annual return is rendered if possible.”

Q. 144.—Will a squad of casualties consisting of men of different companies execute the volley, independent, and skirmishing practices separately by companies?

A.—No; they will execute them together.

Q. 145.—Why are the men of different companies to fire at separate targets in the skirmishing practice?

A.—“In order that the points they obtain may be secured for the company to which they belong.”

Q. 146.—Will one summary do for a squad of casualties?

A.—Yes.

Q. 147.—What points are credited to each man of the squad in the volley and independent practices?

A.—The average points obtained by the squad in those practices.

Q. 148.—Where will the men of a battalion detached from head-quarters be exercised?

A.—With the regiment nearest at hand, unless relieved for the musketry course.

Q. 149.—To whom will their performances in the former case be sent?

A.—To their commanding officers.

Q. 150.—Why are their performances to be forwarded to their commanding officers?

A.—For embodiment in the returns of their respective companies.

Q. 151.—Who is responsible for the correctness of these returns?

A.—The officer superintending and signing for the practice.

Q. 152.—Who alone are excepted from the annual course of rifle training?

A.—The regimental staff, who must have been fully trained; men who, being unfit for the service, are about to be brought forward for discharge; and lads incapable of bearing arms.

Q. 153.—Who form the regimental staff alluded to above?

- A.—(1) Serjeant-Magor.
 (2) Military Bandmaster.
 (3) Quartermaster-Sergeant.
 (4) Sergeant-Instructor of Musketry.
 (5) Paymaster-Sergeant.
 (6) Orderly-room Clerk.
 (7) Drum-Major.
 (8) Armourer-Sergeant.

Q. 154.—Are drummers to be trained annually?

A.—Yes; unless they are lads incapable of bearing arms.

Q. 155.—May soldiers be exempted from rifle training, or from doing duty in the ranks, in consequence of alleged bad sight?

A.—No.

Q. 156.—Why is this strictly forbidden?

A.—Because “it is calculated to lead to malingering and other evils detrimental to the efficiency of the troops.”

Q. 157.—At what distance will a man be required to fire who has been reported by the medical officer unable to see up to 300 yards?

A.—At 200 yards.

Q. 158.—How will he be classified?

A.—“According to the points he obtains.”

Q. 159.—Are his points included in the totals from which the averages, representing the merit of the shooting, are framed?

A.—Yes.

Q. 160.—How will men be classified who are unable to see up to 200 yards?

A.—As 3rd class shots.

Q. 161.—In what return are the names of such men specified?

A.—“In the column of remarks in the first page of the annual return.”

Q. 162.—Will they be included in calculating the ‘figure of merit’ of the company, and battalion?

A.—Yes.

Q. 163.—When should any men who were not available for rifle instruction when the annual practice return was rendered, be exercised?

A.—Previous to the commencement of the next course.

Q. 164.—Under what head are their performances entered?

A.—Under the head of ‘casuals at termination of annual course.’

Q. 165.—Are any men who may be employed, exempted from the annual course on the ground of their having been once fully trained?

A.—No.

Q. 166.—What arrangements are to be made in order to ensure the drilled soldier keeping up the instruction imparted to him as a recruit?

A.—“Arrangements are to be made for the men of each troop or company, while the annual course is proceeding, being catechised in cleaning arms and theoretical principles by the officer-instructor or some other officer in possession of a certificate from Hythe.”

Q. 167.—What is to be done should any men be found deficient?

A.—“They are to be put through a course of instruction in the first two of the preliminary drills, as for the recruit, until proficient therein, before going through the next year’s target practice.”

Q. 168.—Who may be excused from this examina-

tion, and from the extra position drills and judging distance practice?

A.—“First-class shots and old soldiers after the second year of their re-engagement.”

Q. 169.—What return are commanding officers to send in when their battalions proceed on foreign service during the annual course?

A.—“The annual practice return completed to the date on which the instruction ceased.”

Q. 170.—To whom is this return to be transmitted?

A.—To the Inspector-General.

Q. 171.—When is this return to be sent to the Inspector-General?

A.—“Not until within a few days of embarkation.”

Q. 172.—When is the instruction to be resumed?

A.—“Immediately on arrival at new quarters.”

Q. 173.—For what purpose are inspectors of musketry to accompany general officers on their tours of inspection?

A.—“For the purpose of furnishing any information they may require to enable them to reply to the several questions, in their confidential reports, in regard to the instruction of officers and men, and the exercise of arms.”

Q. 174.—What is to be done when the figure of merit of a company is below 65?

A.—“The officers of the company are to be required to furnish such explanation as they may be able to give of the causes of such bad shooting.”

Q. 175.—What is to be done in the event of these explanations appearing unsatisfactory, or affording ground for supposing that the officers are deficient in the theory and practice of musketry?

A.—“The inspecting general will, if he think it advisable, require the officers to be further examined by the district inspector, or some other competent officer.”

Q. 176.—Whose duty is it to report the shooting of a corps or company as ‘bad,’ when such is the case?

A.—“The inspector.”

Q. 177.—To whom is this report to be made?

A.—To the general commanding the division or district.

Q. 178.—Who is to call the attention of the commanding officer to the fact?

A.—The general commanding the division or district.

Q. 179.—How often are the non-commissioned officers of such corps or company to be assembled for the purpose of being trained in the “method of communicating instruction”?

A.—“Once a week, for half an hour after morning parade.”

Q. 180.—Who is to superintend these drills?

A.—The officer-instructor, or his assistant.

Q. 181.—In what return is the number of non-commissioned officers attending each drill to be entered?

A.—“In the monthly musketry diary.”

Q. 182.—Who is responsible to the Commander-in-Chief that the rifle training of the troops is conducted efficiently, and according to regulation?

A.—The Inspector-General of Musketry.

PART IV.

PRELIMINARY DRILL.

1. CLEANING ARMS.

Q. 183.—What is taught in this branch of instruction?

A.—“The names of the limbs and pins of the lock, and the rules for keeping the rifle in proper order.”

Q. 184.—What is to be impressed upon the minds of the men?

A.—The impossibility of producing accurate shooting with a dirty rifle.

FIRST LESSON.

Q. 185.—What is the recruit taught in this lesson of cleaning arms?

A.—“The names of the limbs and pins of the lock, and how to dismount it.”

Q. 186.—What is the first thing to be done in dismounting the lock?

A.—“Unscrew, and remove the tumbler pin.”

Q. 187.—Why do you put the lock at full-cock before removing the main-spring?

A.—In order to place the cramp on the main-spring.

Q. 188.—Why do you let the hammer down previous to removing the main-spring?

A.—In order that the main-spring may be retained in the cramp.

Q. 189.—Why is the sear-spring pin, at first, only partially unscrewed?

A.—In order to “place the edge of the turn-screw between the bend of the sear-spring and lock-plate.”

Q. 190.—For what purpose is this done?

A.—To raise the stud of the sear-spring from the lock-plate.

Q. 191.—How is the sear-spring then removed?

A.—By unscrewing the sear-spring pin.

Q. 192.—How do you remove the sear?

A.—By unscrewing the sear pin.

Q. 193.—What is the next limb to be removed?

A.—The bridle.

Q. 194.—How is this done?

A.—By unscrewing the bridle pin.

Q. 195.—How is the hammer to be removed?

A.—“By a few smart taps with a piece of wood, as near the lock-plate as possible.”

Q. 196.—How is the hammer to rest, previous to being removed?

A.—In the hollow of the hand.

Q. 197.—What is the next limb to be removed?

A.—The tumbler.

Q. 198.—What is the name of the limb which is then to be detached from the tumbler?

A.—The swivel.

Q. 199.—Name the limbs and pins of the lock in the order in which they are removed.

A.—Main-spring, sear-spring, sear, bridle, hammer, tumbler, swivel, lock-plate, tumbler pin, sear-spring pin, sear pin, bridle pin.

Q. 200.—How many limbs and pins are there in the lock?

A.—Eight limbs and four pins.

SECOND LESSON.

Q. 201.—What is taught in this lesson?

A.—“How to clean the lock and rifle, and to keep them in proper order.”

Q. 202.—What is the first thing to be done when the lock is dismounted?

A.—“Wipe the several limbs, first with an oiled rag, and then with a rag quite dry.”

Q. 203.—How are specks of rust to be removed?

A.—With an oiled rag.

Q. 204.—May brick-dust, or powder of any kind, be used to remove rust?

A.—No.

Q. 205.—Why is the soldier cautioned against ever using brick-dust to remove rust?

A.—“Because it would have the effect of removing the case-hardening from those parts that are not steel, and thus render them much more liable to rust.”

Q. 206.—What parts of the lock should be oiled before putting them in their respective places?

A.—“The threads of the several pins; the pivot and axle of the tumbler; and the pivots of the swivel.”

Q. 207.—For what purpose are these several parts oiled?

A.—“In order that they may work easily.”

Q. 208.—To what other frictional parts of the lock is it necessary to apply oil when the lock is re-mounted?

A.—The nose of the sear, and between the sear and sear-spring.

Q. 209.—How should oil be applied?

A.—In small quantities, with a feather, or the point of a pricker.

Q. 210.—Why is only a small quantity of oil to be applied?

A.—Because too much is likely to clog the parts.

INSTRUCTIONS FOR CLEANING THE SNIDER RIFLE.

Q. 211.—What is the first thing to be done in cleaning the Snider rifle?

A.—“Half-cock the rifle, and open the breech.”

Q. 212.—What is then to be done?

A.—“Put a piece of rag into the jag of the cleaning rod.”

Q. 213.—What is the soldier to notice in placing this rag in the jag of the cleaning rod?

A.—That the rag covers the jag.

Q. 214.—Why should he take particular care to notice this?

A.—As otherwise the interior of the barrel might be injured.

Q. 215.—May water be used in cleaning the rifle?

A.—No, not after ball firing.

Q. 216.—By what is the first rag to be replaced?

A.—By an oiled woollen rag.

Q. 217.—May water be used after blank firing?

A.—Yes.

Q. 218.—How is the rifle to be held previous to water being poured down the barrel?

A.—At a convenient angle, muzzle downwards, with the breech-block open.

Q. 219.—How is water to be poured into the barrel?

A.—At the breech, so as to allow it to run out at the muzzle.

Q. 220.—Why is this method of pouring water into the barrel adopted?

A.—To “moisten the fouling, and enable it to be removed by a rag at the end of the cleaning rod.”

Q. 221.—Why is water used in cleaning the rifle after blank firing?

A.—Because the water “is not liable to wet the breech-block, or other parts of the breech arrangements of the rifle.”

Q. 222.—How is the rag to be used after water has been poured through the barrel?

A.—The rag may be wetted, and “should be placed over the muzzle and pressed into the bore with the head of the rod, care being taken that the head of the rod is equally covered all round.”

Q. 223.—What is to be done when this rag is removed?

A.—The barrel is to be wiped out with rag or tow, until it is perfectly dry, and afterwards with an oiled rag.

Q. 224.—Why should the breech-shoe and breech-block be rubbed over with an oiled rag?

A.—“To remove dirt, and to prevent rust.”

Q. 225.—What is the last thing to be done?

A.—“Close the breech and ease springs.”

Q. 226.—Is the use of ‘nosing sticks’ prohibited?

A.—Yes.

Q. 227.—For what purpose were ‘nosing sticks’ used?

A.—“To clean the inside of the muzzle of the rifle.”

Q. 228.—What is to be done every morning, and on all occasions before using the rifle?

A.—The barrel is to be wiped out perfectly clean and dry.

Q. 229.—Why is the soldier cautioned against ever using extreme force when his rod sticks in the barrel?

A.—“Because the bore is almost sure to be injured by such a process.”

Q. 230.—Who is to be called upon to remove the rod in such a case?

A.—The armourer.

Q. 231.—What advantages will accrue, by observing the foregoing rules for cleaning the rifle?

A.—“The liability of the barrel to become rusty will be very much reduced, and the frequent necessity for removing it from the stock, which is always objectionable, be obviated.”

Q. 232.—Why is the stock to be rubbed over with oil?

A.—To give it a smooth and polished appearance, and to prevent water soaking into it.

Q. 233.—To what parts of the rifle, and for what purpose, is beeswax to be applied?

A.—“Between the stock and barrel, and between the lock-plate and stock, to prevent water getting under the barrel, or into the lock.”

DIRECTIONS FOR REMOVING AND REPLACING THE BLOCK OF THE MARTINI-HENRY RIFLE.

Q. 234.—What are the three things to be done in order to remove the block?

A.—(1) “Close the action.”

(2) “Press out block axis pin.”

(3) “Depress the lever and hold down front of block with left thumb, close the lever and the block will spring out.”

Q. 235.—How do you replace the block?

A.—“Place the block in the body, with the front end lowest; hold the lever with the right hand, the thumb pressing the indicator forward, the trigger being pressed back with the fore-finger; press hard on the knuckle of the block with the heel of the left hand to force it into its seat; at the same time depress and work the lever to get the tumbler into the slot in the striker; replace block axis pin.”

Q. 236.—Who are allowed to remove and replace the block?

A.—Intelligent non-commissioned officers and men; the breech action is on no account to be tampered with by the soldier.

Q. 237.—By whom are all the necessary alterations to be performed?

A.—By the regimental armourer.

INSTRUCTIONS FOR CLEANING THE MARTINI-HENRY RIFLE.

Q. 238.—What is the first thing to be done?

A.—Open the breech.

Q. 239.—May water be used for cleaning the rifle?

A.—No.

Q. 240.—What parts of the block should the soldier be particularly careful not to injure?

A.—The face of the block, and the striker hole.

Q. 241.—What oil is to be preferred for cleaning the rifle?

A.—Mineral oil.

NOTE.—The rules for cleaning the Snider rifle apply equally to the Martini-Henry.

THIRD LESSON.

Q. 242.—What is the recruit taught in the third lesson of cleaning arms?

A.—How to remount the lock.

Q. 243.—What do you attach to the tumbler ?

A.—The swivel.

Q. 244.—How do you place the tumbler in the lock-plate ?

A.—“ In the axle-hole of the lock-plate with its bearer against the hind stud.”

Q. 245.—On what part of the tumbler is the bridle then to be fixed ?

A.—On the pivot of the tumbler.

Q. 246.—How is the bridle retained in its position ?

A.—By a stud which fits into the lock-plate, and a pin.

Q. 247.—How does the bridle pin differ from the sear pin ?

A.—The bridle pin has a longer thread than the sear pin.

Q. 248.—How is the sear then placed in position ?

A.—“ Between the bridle and the lock-plate, with its nose against the tumbler.”

Q. 249.—What is to be done when the sear is in position ?

A.—The sear pin is to be screwed home.

Q. 250.—How does the sear pin differ from the bridle pin ?

A.—By the thread next its head terminating abruptly.

Q. 251.—Why is the thread of the sear pin made to terminate abruptly ?

A.—In order to prevent its being screwed too far into the lock-plate.

Q. 252.—What is the next limb to be remounted ?

A.—The sear-spring.

Q. 253.—How is this done ?

A.—“ Partly screw the sear-spring to the lock-plate, then with the thumb of the left hand press the spring against the body of the sear until the stud enters the stud-hole, and screw home the sear-spring pin.”

Q. 254.—How, and in what position, is the hammer fixed to the tumbler ?

A.—On the squares of the tumbler, in a position as if on the nipple.

Q. 255.—What is then done?

A.—The tumbler pin is screwed home.

Q. 256.—How is the swivel attached to the main-spring?

A.—“By its pivots to the claws of the main-spring.”

Q. 257.—How is the main-spring then placed in its position?

A.—“By placing its stud in the lock-plate, and its catch against the fore stud.”

Q. 258.—What do you do when the main-spring is in position?

A.—Full-cock the lock, and remove the cramp.

Q. 259.—What do you do when the cramp is removed?

A.—“Try the action of the lock, and afterwards ease to half-cock.”

FOURTH LESSON.

Q. 260.—What is explained in the fourth lesson of cleaning arms?

A.—“How the rifle and ammunition may get out of order, and how this may be prevented.”

Q. 261.—What should be the position of the several pins and pivots, in order to ensure a true and easy action of the lock?

A.—“The several pins, pivots, &c., should be perpendicular to the lock-plate, which should be a perfect plane.”

Q. 262.—What is the cause of the pull-off being too great?

A.—“Either the full-bent and sear-nose are not well adapted to each other, or the sear-spring is too strong.”

Q. 263.—Can an easier or lighter pull-off be obtained by loosening the sear or any other pin?

A.—No.

Q. 264.—What is such a measure only calculated to do?

A.—“To impair the lock, by causing an increased

wear and tear of the parts, which are thereby thrown out of truth."

Q. 265.—Who alone is allowed to remedy any defects in the pull-off?

A.—The regimental armourer.

Q. 266.—When is a lock said to be wood-bound?

A.—"When the parts are so embedded in the wood-work of the stock as to prevent them from exercising their proper functions."

Q. 267.—How does this defect arise?

A.—From the swelling of the wood by exposure to wet, or from screwing the lock too tightly to the stock.

Q. 268.—What should the soldier notice with regard to the side nails and pins of the lock, when they are screwed home?

A.—That they do not protrude beyond the outer side of the lock-plate.

Q. 269.—Under what two heads may miss-fires be classified?

A.—(1) "Those attributable to the neglect of the soldier."

(2) "Those over which the soldier has no control."

Q. 270.—What are those attributable to the neglect of the soldier, caused by?

A.—"By the dirty or rusty state of the tumbler axle-hole, and axle of the tumbler, which impedes the fall of the hammer, and by dirt or rust on the piston, which prevents the free transmission of the blow to the cartridge."

Q. 271.—What are those over which the soldier has no control, caused by?

A.—A weak main-spring, and want of free action in the piston.

Q. 272.—By whom should these defects be remedied?

A.—By the regimental armourer.

Q. 273.—What is a miss-fire?

A.—The non-ignition of the charge.

Q. 274.—What would be the effect if the barrel of the rifle became dented or bent?

A.—“Either of these defects would be detrimental to good shooting.”

Q. 275.—For what purpose is the soldier on no account to use his rifle?

A.—“For carrying weights, or for any other purpose than that for which it is intended.”

Q. 276.—What is the soldier cautioned against?

A.—Putting his rifle forcibly in a rack, and piling arms carelessly.

Q. 277.—How is rust caused?

A.—By the joint effects of moisture and air.

Q. 278.—What is the surest way of preventing rust in the barrel?

A.—To keep the bore perfectly dry.

Q. 279.—How would a rusty barrel affect the passage of the bullet through the bore?

A.—“The increased resistance offered by the rust to the passage of the bullet will prevent its full expansion, impair its rotation, probably cause it to ‘strip’ (i.e. pass out of the grooving), or may even cause the plug to be driven through the bullet, when the arm for the time will be rendered useless.”

Q. 280.—What would be the effect if the rifle were fired with any obstruction in the muzzle?

A.—“The barrel might be damaged beyond repair.”

Q. 281.—How is the soldier recommended to pack his pouch, in order to preserve his ammunition in an efficient condition?

A.—“The pouch should be well packed, and no vacant spaces allowed in any of the compartments in which there are cartridges.”

Q. 282.—Why is the soldier recommended to adopt this plan?

A.—Because by this means he is more likely to keep his powder dry.

Q. 283.—Whose permission is it necessary for every non-commissioned officer and soldier to obtain, before

he is allowed to remove his lock from the stock and take it to pieces?

A.—The officer-instructor's; who is to certify officially that the soldier "is thoroughly acquainted with the foregoing instructions in detail, and is capable of doing so accurately and efficiently."

Q. 284.—By whom is the operation of removing the barrel from the stock invariably to be performed?

A.—By the regimental armourer or his assistant.

Q. 285.—Why is the soldier not allowed to remove the barrel from the stock?

A.—Because "this service requires great care in its execution to prevent the head of the rifle being broken, and more particularly as the ordinary turn-screw is not adapted either for removing or replacing the breech nail."

Q. 286.—How may the strength of the several springs of a lock be ascertained?

A.—"Weight of main-spring, or main-spring draws." { When the lock is at half-cock, attach such a weight to the comb of the hammer as will just move it or overbalance the main-spring.

"Weight of sear-spring, or sear - spring draws." { "When the lock is at its bearing, attach such a weight to the arm of the sear as will lift or overbalance the sear-spring."

"Pull-off of the lock, or pull-off without trigger." { "When the lock is at full-cock, attach such a weight to the arm of the sear as will raise the sear-nose out of the full bent of the tumbler to allow the hammer to fall."

"Trigger draws, or pull-off with trigger." { When the lock is at full-cock, attach such a weight to the trigger as will raise the sear-nose out of the full bent of the tumbler, to allow the hammer to fall.

2. THEORETICAL PRINCIPLES.

FIRST LECTURE.

In the theory of musketry we explain the reasons for those rules which have to be attended to in practice. Before commencing, however, it may be well to explain certain terms which constantly occur in our lectures.

1st Definition.—A straight line is the shortest distance between two points, thus AB is a straight line.

2nd Definition.—Parallel straight lines are those if which continued in the same direction either way always preserve the same distance from each other.

3rd Definition.—A horizontal line is one parallel to the horizon.

4th Definition.—A line standing straight upright on a horizontal line is said to be perpendicular or vertical to it.

5th Definition.—Two straight lines meeting at a point form what is called an angle, provided they do not meet in the same straight line.

1. *The first thing to be considered is the construction of the barrel. The inside† of the barrel or bore is made round, and of nearly the same size throughout; in other words, it is cylindrical in shape, having its opposite sides straight and parallel. The barrel is thicker at the breech than at the muzzle,‡ in order that it may have strength to withstand the explosion of the charge, the greatest effect of which

* Place the upper surface of the model of rifle horizontal, draw a line along the upper surface, and another down the centre of the bore, producing both some little distance.

† Take up the barrel as you say these words.

‡ Here point to difference shown on model.

takes place at the breech; therefore a straight line drawn along the centre of the bore would not be parallel to, or, in other words, at an equal distance throughout from a similar line drawn along the upper surface of the barrel. If, then, these lines were produced, they would cross each other, and form an angle * a short distance in front of the muzzle, consequently if the upper surface of the barrel was laid horizontally as I have placed the model, the line drawn along the centre of the bore produced would, after crossing, † rise above the line drawn along the exterior surface of the barrel; thus showing that the direction of the barrel would be elevated above the horizontal line, or that the barrel has elevation in itself. This construction of the barrel makes it balance better, and lighter for the soldier to carry on the march. ‡

2. The straight line above described as drawn along the centre of the bore is called the axis of the barrel, § and is the line the centre of the bullet must take in its passage through it. It commences at the breech, and ends at the muzzle, || and is of course an imaginary line. Thus A B represents the axis of the barrel.

3. ¶ The continuation of the axis of the barrel is called the line of fire, it begins where the axis ends, and may be continued in a straight line as far as you like. We will call B F the line of fire. ** This also is an imaginary line, and shows the direction in which the bullet is proceeding from the force of the explosion of the powder at the instant that it leaves the muzzle, and which direction it would naturally continue to

* Point to the angle.

† Here point to where the lines cross and the one rises above the other.

‡ Rub out the above lines, and draw one along the centre of the bore horizontally, letter it A B.

§ Here point to axis.

|| Point to where the axis begins and ends.

¶ Produce the line A B to F.

** Here point to B F.

follow at the same pace for ever and ever were it not impeded by the resistance of the air, and drawn from it by the force of gravity.

4. The atmosphere, or common air we breathe, and which surrounds the earth, is an elastic fluid ; it consists of a number of small particles which press against each other and against everything touching them, these cannot be set aside by the bullet without destroying a portion of its speed, thereby making it move slower and slower during every successive instant of its flight ; and remember, the greater the speed with which the bullet is flying, the greater the resistance it meets with from the air ; this resistance therefore is the greatest at the moment the bullet leaves the muzzle ; this resistance of the air, then, making the bullet go slower and slower, would at last stop it altogether, and the bullet would remain hung up, as it were, at some point in the line of fire* if it were not for the other force, namely, the force of gravity, which is also acting upon it.

5. The force of gravity is a law of nature which draws all unsupported bodies towards the centre of the earth. Gravity acts in proportion to time, that is to say, the longer a body is exposed to its influence the faster it falls. It begins to act upon the bullet the moment it leaves the muzzle and loses the support of the barrel.

6. So, then, besides the force of the exploded gun-powder we have two other forces acting upon the bullet, namely, the force of gravity, drawing the bullet down quicker and quicker, called therefore an accelerating force, and the resistance of the air, making the bullet travel slower and slower in each successive instant of time, and called therefore a retarding force. The result of these forces, the one decreasing as the other increases, is to draw the bullet to the ground in

* Here place a mark on the line of fire about 2 feet from the end of the board, and letter it H.

a curved line called the trajectory.* B T represents the trajectory. At first, in consequence of the bullet moving forward with great speed, and the little time gravity has had to act upon it, the trajectory or curved path of the bullet does not fall much below the line of fire †; but at the longer ranges, owing to the reduced speed of the bullet and the increased action of gravity, the curve becomes very great, in fact greater and greater as the bullet becomes distant from the muzzle.

SECOND LECTURE.

7. ‡ I will now proceed to show you how the knowledge of the principles explained to you in the first lecture can be applied to practice. You will observe from this figure that if the axis of the barrel be directed straight on an object the bullet will not hit it, but must, in consequence of the force of gravity, fall below it. It has been found by experiment that the bullet fired from the Martini-Henry rifle with the regulated charge falls about 10 inches in passing over the first hundred yards from the muzzle. If, therefore, we assume that H is 100 yards from the muzzle, the bullet would fall to a point C in the trajectory immediately below H; and therefore, in order to hit an object at that distance, the axis must be raised so that the line of fire may pass through a spot 10 inches above the said object,§ when the trajectory, which always conforms to the line of fire, will also be raised 10 inches,

* Draw the trajectory, as you say these words, from the muzzle to the end of the board, and letter it B T.

† Here point to the curve.

‡ Before commencing this lecture draw a vertical line H C from the mark H to the trajectory, letter it H C and write 10 inches against it; also assign a distance of 100 yards to B H.

§ Draw a line H F above H = to H C, write 10 inches against it; then change the direction of the axis, and draw a new line of fire B F passing through F.

and the bullet will strike the mark.* To avoid confusion I will now rub out the old line of fire and old trajectory.

8. I will now explain to you how we are able to direct the axis of the barrel in the required line, so that the rifle may have the elevation for 100 yards. The axis can only be directed on an object by means of the eye, and as we cannot look along the axis itself, as it is inside the barrel, we must bring two spots on the outer surface of the barrel into alignment with the eye and the spot required. Supposing the upper surface was parallel to the axis, and aim was taken close along it, in directing the line of fire on a spot 10 inches above the object at 100 yards, the muzzle would be raised between the object and the eye of the firer, and he could not be certain whether it were directed exactly 10 inches above the object, or whether it were not directed to the right or left of the required spot. It is thus evident that to fire with accuracy the object must always be kept in view, and to do this the eye must be raised above the breech high enough to see the object over the muzzle of the rifle. As a guide to the exact elevation of the eye above the breech, as well as to keep it vertically over the axis, a back-sight is fixed to the barrel of such a height that, together with the elevation in the barrel itself, as explained in the first lecture, when the firer brings the tip of the fore-sight and the object in a line with his eye over the notch of the back-sight the necessary elevation is obtained for 100 yards, the line of fire passing through a spot exactly 10 inches over the object. I will now draw the line of sight.†

* As you say these words draw the new trajectory striking the mark.

† Here draw the line of sight passing over the top of the fore-sight on to the object, adjusting the back-sight to the required height.

9. With a view to show you that the sight for 100 yards will not be sufficient for 200 yards or any greater distance than 100 yards, I will take a point S on the prolongation of the line L O H, and assign to it a distance of 100 yards from H. You will observe by looking at this figure that the trajectory or actual path of the bullet crosses the line of sight twice, once a short distance in front of the muzzle, and again at the object H, and falls below the line of sight or aim ever afterwards; this fall becomes greater and greater as the distance increases, in consequence of the decreased speed of the bullet and the continued action of gravity. The rule consequently is, that as the distance increases we must allow for the increasing curve in the trajectory, directing the line of fire as much above the object as the bullet would, at the given distance, whatever it might be, fall below the object if the line of fire had been directed straight upon it at that distance. To guide the firer as to the exact height to which he must raise his eye at each distance, the back-sight is furnished with a hinged leaf and slide, on which the proper elevation is marked for all distances from 100 yards to the utmost extent to which the rifle is constructed to carry with accuracy, so that, if he knows the distance, he has only to adjust the sight accordingly. If he should want to fire at objects at a greater distance than that for which his rifle is sighted, he must judge for himself the additional height which his eye should be raised above the back-sight, taking care always to keep it vertically over the notch and to align the fore-sight carefully on the object. If he should want to fire at an object nearer than 100 yards he must remember that 100 yards being the shortest distance for which his rifle is sighted, the trajectory or actual path of the bullet will be in a curve above the line of sight within that distance, and that, therefore, to hit an object at a less distance than 100 yards he must

aim a little below it; at 50 yards this would be about 3 inches.*

10. In order to show you the relative position of the line of sight and the line of fire more clearly, as well as the angle that is formed by them, I will rub out the trajectory, leaving only these two lines on the board.† As I have already pointed out to you, these two lines meet and cross each other a short distance in front of the muzzle, where they form an angle called the angle of elevation; the longer these lines are produced the further apart they get. You are now looking at these lines sideways, but I will give you an end-on view of the same lines, such as you would obtain if you looked at these lines from this end of the board.‡ To do this I have a barrel with the breech arrangements removed, which we will place on a rest at the end of the room, and I will draw on the board a vertical or upright line H' K.§ Will one of you aim at this point H', using the 900 yards sight, taking care to keep the sights perfectly upright, and remembering that you are now looking along the actual line of sight; having done this, look along the actual line of fire, and you will see where the line of fire cuts the vertical line, namely at F'.|| Now if we assume that H' corresponds with H in the side view, F' will correspond with F, and you see that the line of fire is now directed exactly over the spot you wish to hit, and that the line of fire, which at the

* Show this by the figure, putting a mark across half-way between B and H on the line of sight, and mark it 50 yards, then make a mark at this point, as much below the line of sight as the curve of the trajectory passes above it at that point, mark it 3 inches. Indicate that it is at the latter mark that aim should be taken to hit an object 50 yards off.

† Here rub out the trajectory, and the lines of fire and sight beyond the points F and H.

‡ Go to the end of the board and look along the model gun and lines.

§ Draw a vertical line H' K with H' a point to aim at.

|| Here mark the point F' on the vertical line H' K.

muzzle was below the line of sight, has crossed it, and now passes through a point much above it, namely F'.

11. I will now draw your attention to the great necessity of observing the first rule in aiming, namely, keep your sights upright, and will prove that if you do not the bullet will invariably strike low and to that side to which the sights are inclined. The greater the distance and the greater the inclination of the sights the greater will be the error. To prove this I will again ask you to aim at this spot H' with the same 900 yards sight up but inclined to the right. On looking through the barrel you will see that the line of fire no longer cuts the vertical line H' K in F' but is directed to the right and below F', namely at M; consequently, as the trajectory always conforms to the movement of the line of fire, and owing to the force of gravity must always be exactly under it, the bullet instead of hitting the mark H' will strike as much below M as H' is below F. I will now draw a new vertical line from and below M and will measure off a distance equal to F' H', namely M O; O is the spot the bullet will really hit. To show the loss of direction and elevation, I will draw a horizontal line from H' to R on the vertical line M O. H' R will represent the loss of direction, and R O the loss of elevation caused by the inclination of the sights even at the little distance the barrel is now from the board, say some ten yards: you must remember that these errors would at 800 yards or 900 yards be proportionally greater according as the distances 800 yards or 900 yards are greater than ten yards, the distance the barrel is now from the board. You can get an accurate idea of what the actual error would be by a simple calculation as follows: supposing the barrel to be 10 yards from this board and H' R to represent half a foot, and R O three inches, then the calculation would run thus:—

Yards.	Yards.	Inches.	
10	:	900	:: 6 = 45 feet.
10	:	900	:: 3 = 22½ feet.

THIRD LECTURE.

12. * During the latter part of the last lecture I drew your attention to the great necessity of keeping your sights properly upright at the moment of firing, and I think I very clearly proved to you that if you did not do so a loss of elevation and direction would be the result. In order the further to show you how elevation is lost by inclining the back sight, I have drawn upon the board a representation of a perfectly upright back sight with lines across it to show the height to which the eye must be raised to give the rifle the necessary elevation at the different distances. I have also drawn alongside it another similar back sight marked in like manner, but inclined to the right.† You can see plainly that if I take aim over the inclined sight, say at an object 900 yards distant, in reality my eye is only raised sufficiently above the breech to give 850 yards elevation.‡

13. Again, I can show you the error of elevation and also of direction caused by inclining the sights by means of this model of a gun,§ which has, you perceive, three wires attached to it; these wires represent|| the line of fire, the line of sight, and the trajectory. The trajectory is, you see, made to hinge upon the line of fire, to show the course the bullet would pursue at any degree of inclination of the back sight, and also to show that the trajectory always preserves the same relative position below the line of fire. Now when I hold the model gun with the sights perfectly upright, you see that the trajectory

* Before this lecture is commenced all the figures for the third and fourth lectures should be drawn on the board.

† Point to inclined back sight.

‡ Place a ruler horizontally through the elevation for 900 yards on the inclined sight, so as to meet the upright sight.

§ Take up the model and hold it so that the men can see the wires.

|| Indicate the three different wires.

meets the line of sight at the mark at which aim is taken, in this case my finger;* when, however, I incline the sights the bullet leaves the said mark and goes low and to that side to which the sights are inclined.† The greater the inclination of the sights the greater does this deviation become.

14. I will now explain to you the height of the trajectory at the several ranges, and the distances that cavalry and infantry are respectively under the power of the rifle, when it is fired with the several elevations marked upon the back sight. My object in giving you this explanation is to impress upon you the great importance of training yourselves to judge distance. I showed you in my last lecture that the back sight must always be adjusted for the correct distance; this, however, you would be unable to do if you were not thoroughly trained to judge distance by the eye. You must remember that however good a shot you may be at a fixed mark, the distance of which is known, you will be comparatively useless if you are not able to hit your enemy in the field, which is the aim and object of all your training. To show you the importance of judging distance the table on the board before you has been prepared; it is called a trajectory table, and is divided as you see into five heads, the meaning of which I will now explain.‡ In the column headed distance the several ranges are entered. The culminating point shows the greatest height above the ground of the trajectory; this is to be found between

* Hold the model so that the wires are directed towards the men, keep the back sight upright, and place the forefinger of the left hand at the end of the wire representing the line of sight.

† Incline the model to the right without moving the finger from the end of the line of sight, bring the model end on to the audience.

‡ The trajectory table must be written on the board before commencing paragraph 14. As you explain point to it, and to the parts of the trajectory-board.

one-half and two-thirds of the distance, and increases from one-half to two-thirds as the distance increases. The first catch is the point in the trajectory where the bullet has descended sufficiently low to strike the object fired at in its highest point. The margin shows the space in yards in which the object fired at is under the power of the rifle; it begins at the first catch, where the object is hit in its highest point, and ends at the first graze, which is the point where the bullet would first strike the ground if not interfered with; the margin is in fact the dangerous part of the trajectory. In calculating this table the height of a cavalry soldier is assumed to be $8\frac{1}{2}$ feet from the ground, that of an infantryman 6 feet. The height of the rifle from the ground, when fired from the shoulder standing up to 300 yards, is $4\frac{1}{2}$ feet, and beyond that distance 3 feet. The mark aimed at is always taken as the centre of a bull's-eye 3 feet from the ground. The first catch and first graze are given in divisions of five yards, and the culminating point in divisions of three inches, to assist the memory; they are consequently only approximations.

15. You will see, by referring to the table and looking at this figure,* which is the 100 yards trajectory of the Martini-Henry rifle, that if the rifle be fired from the shoulder standing, that is $4\frac{1}{2}$ feet above the ground, at the centre of a bull's-eye 100 yards distant and 3 feet above the ground, the axis is directed on a point 3 feet 10 inches above the ground, and the bullet therefore never rises above the height of the firer's shoulder. You will also observe that the bullet, which in the first 100 yards of its course only fell 10 inches, would, after passing through the bull's-eye, if the latter were made of paper, strike the ground 105 yards behind it, thus showing that in this latter distance it fell 3 feet, and consequently in passing over the second 100 yards of its course it would fall very

* Here point to figure.

nearly 3 feet, proving practically what was shown in the second lecture, that the elevation for 100 yards is not sufficient for 200 yards or any greater distance than 100 yards.

16. * You will further see on referring to the table and to this figure showing a portion of the 300 yards trajectory,† that if the rifle be fired at the same target with the elevation for 300 yards, the bullet will fall from a height of 6 feet above the ground in passing over the last 155 yards of its course, within which distance a man of ordinary height is liable to be hit. If however the rifle were fired with the elevation for 600 yards,‡ the bullet would fall from a height of 6 feet above the ground in the last 65 yards of its course, showing that the margin or dangerous part of the trajectory is much less at 600 yards than at 300 yards, and that a mistake in judging the distance at this range of about 33 yards either way would probably cause the bullet merely to graze the top of a man's head or to strike the ground at his feet. At the still longer ranges of 700 yards and 800 yards you will see by this table that the bullet falls from the height of 6 feet above the ground in the last 55 yards and 45 yards respectively, still further reducing the margin, and showing that it is of much greater importance to judge distance accurately at the longer ranges than at the short where it is comparatively easy. For this reason it would not only be useless but a waste of ammunition for men who are not good shots and well trained to judge distance accurately, to fire at such long ranges at an enemy, unless the same were in column, the depth of which would allow for considerable error in estimating the distance, for were the bullet to pass over the first companies it might

* Draw the figure of the 600 yards trajectory first and then the other for the 300 yards trajectory, so as to get the margins in the two figures in proper proportion to one another.

† Here point to the table and to the figure.

‡ Here point to the table and to the figure.

fall among those in rear.* It is however difficult to make certain of the distance in the field, and it is therefore advisable, particularly at long ranges, to fire the first shot with an elevation rather under than over that which is due to the estimated distance, since by watching where the bullet strikes the ground, which will probably be seen by the dust thrown up, the firer will gain a better idea of the real distance and the elevation that he requires, and also his shot may take effect upon the enemy by ricocheting into him.†

FOURTH LECTURE.

17. I will now proceed to explain to you the means of counteracting certain things which may casually interfere with the correct flight of the bullet or with the aim.

18. "Wind, which is air in motion, will by its pressure affect the progress of the bullet, driving it to the left if it blows from the right, and if from the left to the right of the line of fire. If blowing from the front it will add to the resistance and consequently decrease its range, if from the rear, by diminishing the resistance, will enable the bullet to fly farther. As no fixed rule can be laid down to guide the soldier, he must acquire experience as to the amount of allowance he should make for wind in carrying his rifle to the side from which the wind is blowing, or in giving his rifle a little more or less elevation, but always taking into consideration two things, viz., the strength of the wind and the distance of the object at which he is firing, since on the latter will depend the length of time the wind will have to act. He should also watch the effect of each shot, and make more or less allowance

* Indicate the course of the bullet by the figure on the board.

† Indicate bullet ricocheting into the ranks.

as he finds necessary; and he must also bear in mind that the effect of a wind from the front or rear is much less than a side wind, which acts on a larger surface of the bullet."

19. "If an object fired at be moving, whether it be man or horse, it is obvious that it will pass over a certain distance between the moment of discharge and the time when the bullet reaches it; if the object be moving across from left to right or from right to left, the soldier must therefore carry his aim a little to the front of it, but how much must depend, first, on the speed it is going at, and, secondly, on the distance it is from the firer, and the consequent time the bullet will have to travel. The firer must exercise his own judgment in this matter, as no fixed rule can be laid down for his guidance."

20. "When firing at an object moving, or during wind, in order to get the correct elevation, which would not be ensured if aim were not first taken on the object, the soldier must first align the sights on it in the usual way, and then, without pausing or dwelling on the aim, move the rifle sideways in the direction and to the extent required, by turning the body on the hips, keeping the lower limbs firm, and the arms and eye perfectly steady. Should the object be advancing towards or retiring from the firer, he should regulate his sliding bar for the distance he calculates it will have reached at the moment his bullet will arrive at it."

21. "It may occur that the soldier may be required to keep up a fire on an enemy whom he is prevented from seeing, either from the darkness of the night, or by clouds of dust, or smoke of gunpowder, temporarily rising between his eye and the object. For the former, which may often be the case in the attack or defence of works or positions, if he can get an opportunity during daylight, he should plant firmly in the ground two forked sticks, in such a position and of such height respectively that his rifle, when laid on them,

may command the point desired, and have the proper elevation. Should he, on the other hand, by day, in action, find that clouds of dust or smoke occasionally drift across and conceal the enemy from sight, he may, during a clear interval, plant a single stick or his rod a few feet in front of him, so that the top of it may be in a line between his eye and the object at which he is firing, and he can, when it becomes obscured, keep up an efficient fire by aiming at the top of the stick."

22. I will now explain to you the effect which the sun shining on the sights has upon the aim. When the sun is shining from the left it lightens up the left side of the fore sight and the right side of the back sight; if we mistake these two brilliant spots for the true centres of the sights, we would, in taking aim along them, direct the axis to the right, as is made plain by this dotted line drawn through the true centres of the sights.*

23. "It may sometimes occur that the rifle is not accurately sighted as to elevation, and consequently may carry a little high or low. As the marks on the flap, denoting the height to which the sliding bar should be raised for different distances, are not always exactly in the right place (the sights being all made to one pattern), the soldier should be cautioned to pay attention to each shot; if it go low he must raise his sliding bar a little; if high, the reverse. The sights are not always in the proper line. If the back sight be to the right the rifle will carry to the right; if the fore sight be to the right it will carry to the left, and *vice versa*; this defect should be remedied by aiming in the contrary direction."

24. "I will now explain to you how the rifle barrel differs from the smooth bore, which is now laid aside, and the advantages of the former over the latter. A barrel which has any number of grooves cut down it is said to be rifled; these grooves are cut in a spiral direction, in order to make the bullet turn or spin on

* Here point to the dotted line in the figure.

its longer axis. If you look through the barrel you will see the grooves and the degree of twist given to them. In the Martini-Henry these grooves make a complete turn in 22 inches, or about one and a half turns in the length of the barrel, passing over from left to right.

25. "When the bullet is expanded by the explosion of the powder it is not only made to fit the barrel tightly, but is moulded into the grooves in such a way that during its passage through the barrel it is obliged to turn with them, and thus it receives a spinning movement around its longer axis, which continues during the remainder of its flight; this not only prevents a rotation in any other direction, but is in itself calculated to ensure accuracy of flight, by constantly presenting any imperfection of surface to the air in opposite directions. The object, therefore, of spiral grooves is to correct the flight of the bullet, and to cause it to spin or rotate round an axis coincident with its flight, thus keeping its point foremost."

26. The motion of a rifled projectile through the air may be described by means of a bent arrow.* Suppose the arrow, with its bent point placed upwards, were shot from the point A, with a view to hit the mark C, and no spinning motion was given to it, then the greater pressure of the air being on its under or convex side would tend to carry it upwards in the direction D; but if it had previously received a spinning motion, by the time it reached E the point would have turned, and the arrow, proceeding downwards, would descend as far beneath the true 'trajectory' as it had at first risen above it; and thus it would continue throughout its course to move in a spiral direction round the true 'trajectory,' constantly correcting the error due to its imperfect figure, and ultimately it would strike much nearer the mark than if it had received no spinning motion.

27. From the foregoing instruction you will have

* Indicate this by the figure.

learnt the laws which regulate the flight of the bullet, the method of adjusting the sights, and the rules to be attended to at the moment of firing. I would now impress upon you that attention to them alone is not sufficient to insure good shooting, to obtain which it is necessary to keep your rifle clean and your ammunition dry. The rifle given you is a very good one, and the ammunition perfectly adapted to it, but both require care and attention in order to obtain fully the results of which they are capable.

“In order to induce all ranks to take greater interest in rifle practice, the commanding officer should occasionally assemble the officers of the battalion, and non-commissioned officers and men by squads or companies, when the officer-instructor may take the opportunity of explaining more fully the theoretical principles detailed in the foregoing lessons, and of examining those officers and men who may be deficient in knowledge of the subject.”

NOTE.—The figures for the four lectures will be found in the Appendix.

3. AIMING DRILL.

Q. 287.—What is the soldier taught at aiming drill?

A.—How to aim, and to adjust the back sight of his rifle.

Q. 288.—How is his progress in aiming to be tested?

A.—“By making him aim at the different distances from a rest.”

Q. 289.—How can a rest be formed to answer the purpose when traversing rests are not available?

A.—By three stakes tied near the top, or piled

arms with sheathed bayonets fixed, supporting a bag of sand about $4\frac{1}{2}$ feet from the ground.

Q. 290.—What is to be the strength of a squad at aiming drill, and how are the men to be formed?

A.—A squad is to be composed of not more than ten men, formed in single rank at each rest.

Q. 291.—What is each man to have at aiming drill?

A.—His own rifle.

Q. 292.—What is the first thing the instructor is to explain?

A.—The principles of aligning the sights.

Q. 293.—What are the four rules for aiming?

A.—(1) "That the sights should not incline to the right or left."

(2) "That the line of sight should be taken along the centre notch, or over the centre white line of the back sight and the top of the fore sight, which should cover the middle of the mark aimed at."

(3) "That the eye should be fixed steadfastly on the mark to be aimed at, and not on the barrel or fore sight."

(4) "That in aiming, the left eye should be closed."

Q. 294.—Which is the most important rule in aiming?

A.—The third rule.

Q. 295.—At what distance is the soldier to aim when the foregoing rules have been explained?

A.—On a mark 100 yards from him, with the sight for that distance.

Q. 296.—What is the soldier to do when he has aligned his sights on the mark?

A.—He is to step aside, leaving his rifle on the rest, in order that the instructor may take his place to see if his aim is correct.

Q. 297.—What is the instructor to do if he should discover any error in the aim?

A.—He is to call another man from the squad, who is to look along the sights and state the defects.

Q. 298.—Why is it laid down that the instructor is to call another man from the squad to notice the aim when it is not correct?

A.—Because by this method the attention of the soldier is fixed upon the errors in his comrade's aim, and he is more likely to avoid those errors when aiming himself.

Q. 299.—What is the instructor to explain when he notices errors in any soldier's aim?

A.—"What the consequences would be if actually firing at an object."

Q. 300.—What is the soldier whose aim was inaccurate then to be caused to do?

A.—To aim again.

Q. 301.—At what distances is the recruit to aim?

A.—At every 50 yards from 100 to 900 yards, or to the extent to which the rifle is sighted.

Q. 302.—What is the size of the bull's-eye aimed at up to 300 yards, and what beyond that distance?

A.—Up to 300 yards the bull's-eye is to be 8 inches in diameter, beyond that distance 18 inches.

Q. 303.—Why is the recruit to aim at every 50 yards from 100 to 900 yards?

A.—"In order that he may acquire a knowledge of his sights and become perfect in aiming."

Q. 304.—What is aiming drill calculated to do?

A.—"To strengthen the vision."

Q. 305.—What is the instructor enabled to discover at aiming drill?

A.—Whether the recruit has any defect in his eyesight.

Q. 306.—What should be impressed upon the mind of the soldier with regard to shooting at long ranges?

A.—"That to shoot well at long ranges he must train and strengthen his eye, by looking at small objects at distances beyond those at which he will have to fire in practice."

4.—POSITION DRILL.

Q. 307.—What is the soldier put through in this exercise?

A.—“All the motions of firing standing and kneeling.”

Q. 308.—How is the soldier to be put through position drill?

A.—“With the same accuracy as if firing ball, close attention being paid to each motion.”

Q. 309.—What is the object of position drill?

A.—(1) “To habituate the soldier to the correct position.”

(2) “To give him perfect command of his rifle.”

(3) “To establish the connection that should exist between the hand and eye.”

Q. 310.—How does the ‘firing exercise’ differ from the position drill?

A.—“In the ‘firing exercise’ the soldier is instructed in the positions of loading and firing in the ranks by the Adjutant and Sergeant-Major: in the position drill the musketry instructor is to confine his attention exclusively to the essentials of good individual firing.”

Q. 311.—In what order is ‘position drill’ to be executed by drilled soldiers?

A.—“In marching order, except in tropical climates.”

Q. 312.—In what order does the recruit execute his position drill?

A.—In drill order.

Q. 313.—What is the rule about fixed bayonets at position drill in the case of the drilled soldier, and in that of the recruit?

A.—The drilled soldier will execute his position drill with fixed bayonets when standing and unfixed when kneeling; recruits will not be required to fix bayonets.

Q. 314.—What is the maximum strength of a squad at position drill?

A.—Ten men.

Q. 315.—How are the men to be formed?

A.—"In single rank, the men to be one pace apart."

Q. 316.—What is the instructor to point out to each man before commencing this drill?

A.—A mark to aim at.

Q. 317.—How far are the men to be from the marks aimed at?

A.—A convenient distance.

Q. 318.—What are these 'marks' to be?

A.—"Black bull's-eyes the size of a shilling, on a white centre the size of a crown piece."

Q. 319.—How far apart and at what height from the ground are these bull's-eyes to be placed?

A.—"They are to be placed three feet from the ground, and three feet from each other."

Q. 320.—Which practices of the position drill particularly are to be frequently carried on by every company in a battalion?

A.—The first and third.

Q. 321.—Under whose supervision are the position drills to be executed, when the company is not engaged in its annual course?

A.—"Under the personal supervision of the company officers, assisted by the regimental and company instructors."

Q. 322.—What is the object of the first practice of the position drill?

A.—"To accustom the soldier to handle his rifle expertly, to strengthen his left arm so as to give him perfect command over his rifle with his left hand, and to habituate him to raise it to the shoulder, in the direction of the object the eyes are fixed upon, without moving his body."

Q. 323.—When is the instructor to explain the errors that he may notice, and their bad effects?

A.—When the squad is standing at ease.

Q. 324.—What is the instructor to direct his attention to when the men are at the 'ready'?

A.—(1) "To see that every man holds his rifle firmly with the left hand, at the place it is to be held when at the 'present,' viz., just in front of the barrel stud pin."

(2) "That the fingers of the right hand are behind the trigger-guard."

(3) "That the body is erect, the left side being perpendicular, with the left breast over the left foot."

(4) "That the shoulders are at the half-turn, and the feet nearly at right angles."

(5) "That the eyes are fixed upon the mark, or object in front, with the head in the same direction, and erect."

Q. 325.—Why are the men frequently to be brought back to the 'ready'?

A.—"In order to establish the men in the position, to point out errors, and to explain the subsequent motions of the practice."

Q. 326.—What is the object of the second practice?

A.—"To habituate the men to combine the motions of the 'present' in the required order."

Q. 327.—What is the instructor to notice when the men are brought back to the 'ready' position?

A.—"That the men do not lose the erect position of the body, or move the eye from the object pointed out to them severally to aim at."

Q. 328.—What motion will not be performed when coming to the 'ready' position in the 1st and 2nd practices?

A.—The 3rd, or loading motion.

Q. 329.—What is the object of the third practice?

A.—"To establish union between the hand and the eye, which is indispensable to produce good shooting."

Q. 330.—What are the men cautioned to do before coming to the 'present'?

A.—To select some spot or object to aim at.

Q. 331.—In what position may the several practices be executed?

A.—The 1st and 2nd practices may be executed either standing or kneeling, the 3rd practice in any position.

Q. 332.—To what points is most particular attention to be paid when the men are at the 'present'?

A.—(1) "That the sights are upright."

(2) "That the rifle is pressed firmly into the shoulder with the left hand."

(3) "That the trigger is pressed steadily without the least motion of the hand or arm while the muzzle is being raised, and until the spring is released."

(4) That the eye is fixed on the mark during and after snapping.

Q. 333.—Why is the instructor occasionally to cause each man to aim at his eye?

A.—"With a view to ascertain that he obtains the alignment quickly and readily, and that his aim is not lost by pressing the trigger."

Q. 334.—What is the instructor to do should he discover a fault in a recruit's position when the rifle is at the shoulder?

A.—"He is to give the command 'as you were' and cause him to come to the 'present' three or four times in succession, without loading, to correct the defect noticed."

5. BLANK FIRING.

Q. 335. Why is the recruit to be practised in firing blank cartridge before he is allowed to fire with ball?

A.—"To give him steadiness, and to accustom him to the recoil that takes place on the explosion of the powder."

Q. 336.—How are the 40 rounds of blank ammunition, fired by the recruit, to be expended?

A.—10 rounds to be fired singly, standing.

10 rounds to be fired singly, kneeling.

10 rounds in independent firing, front rank kneeling.

10 rounds in volleys, front rank kneeling.

Q. 337.—What is the instructor to direct his attention to in this exercise?

A.—(1) "The position of the body, arms, and hands."

(2) "The manner of pressing the trigger."

(3) "The position of the head when taking aim."

Q. 338.—Why are these three points to be particularly watched?

A.—"In order to discover and correct those errors which are fatal to good shooting, and which cannot be so successfully corrected when firing ball."

Q. 339.—What is the instructor to explain to the recruit as regards the explosion of the powder?

A.—"That the explosion of the powder, at the same time that it sends the bullet out of the barrel, communicates a force backwards, which is called the recoil."

Q. 340.—How may the recoil be controlled?

A.—"By pressing the rifle firmly into the hollow of the shoulder."

Q. 341.—Why is it of great importance to press the rifle firmly into the shoulder?

A.—"Because the more confidently a man stands up to his rifle, the less likelihood is there of random shooting, and the better will be the results of the firing."

Q. 342.—How will the instructor endeavour to make the recruit understand the reason for his being taught to press the centre of the heel plate to the shoulder, and not the toe of the butt?

A.—"By reminding him that the bullet quits the

barrel in the direction of the line of fire, and that the recoil takes place in the opposite direction; also that the stock is bent downwards to enable the firer to look along the barrel, and consequently that the point of resistance, viz. the shoulder, is beneath the line of recoil, the result of which is that the explosion of the charge has a tendency to throw the muzzle up, and thereby send the bullet high."

Q. 343.—What is the soldier cautioned against ever doing while on the range for ball or blank firing?

A.—Aiming or snapping at the target or anyone's eye.

6. JUDGING DISTANCE DRILL.

Q. 344.—What is the drilled soldier and the recruit taught at this drill?

A.—"To note the size and appearance of men and objects at different distances."

Q. 345.—Why is it most important that a soldier should be a good judge of distance?

A.—In order that in the field he may be able to adjust his back sight for the required distance, whatever it may be, with as little delay as possible.

Q. 346.—What are the points for observation for the drilled soldier?

A.—Two or more men placed at every 50 yards from 250 to 500 yards for the first day, and from 550 to 700 yards or to a greater distance if desired for the remaining days.

Q. 347.—What are the points for observation for the recruit?

A.—One man placed at every 50 yards, from 50 to 300 yards for the first four days, and two or more men at every 50 yards, from 350 to 600 yards for the remaining days.

Q. 348.—How are the points for observation to stand?

A.—"Facing the squad or party, at ease, looking

to their front, and remaining in an erect position unless ordered to the contrary."

Q. 349.—What is the first thing to be done in throwing out points?

A.—To select a distant object, and align two men thereon.

Q. 350.—How far are these men apart, and how are they to stand?

A.—Twenty yards apart, facing each other.

Q. 351.—What is the next thing to be done?

A.—To place a man eleven paces to the right or left of the nearest of the two men already thrown out, and at right angles to him.

Q. 352.—Which side is this man to be placed if the points are to be thrown out to right?

A.—To the left.

Q. 353.—Describe what follows, when these base points are fixed.

A.—A squad of six men, formed two deep, is marched off on the alignment chosen, and halted at 50 yards distance, when No. 3 of the rear rank will turn about and cover on the two men already aligned.

Q. 354.—When will the man 20 yards off be removed?

A.—As soon as the man at the 50 yards point is correctly covered.

Q. 355.—How is the squad then to be marched off, and at what distance from the 50 yards point is the squad to halt?

A.—In an oblique direction, $50\frac{1}{2}$ yards or 61 paces from the 50 yards point.

Q. 356.—What man of the squad is then to halt and turn about, and on what two points is he to cover?

A.—No. 3 of the front rank, who will cover diagonally on the 50 yards point, and the base or covering point.

Q. 357.—How far apart are the remaining points to be?

A.—50½ yards or 61 paces.

Q. 358.—When is the covering point no longer required?

A.—When the points for observation are aligned diagonally.

Q. 359.—Why is each man in the above formation placed at a greater distance from the line first marched upon?

A.—“In order that each man may serve, in turn, as a distance point for the men of the squad to make observations on.”

Q. 360.—How far apart are the squad instructors to be?

A.—11 paces apart, and opposite to the points for observation.

Q. 361.—On which flank of the squad instructor is the squad or party to be formed?

A.—“On the left of the squad instructor placed opposite to the point 50 yards off.”

Q. 362.—What are the instructors to direct the men to notice when they are making their observations?

A.—The position of the sun, the nature of the background, and the state of the atmosphere.

Q. 363.—Why is the instructor to caution the men to notice the position of the sun, &c.?

A.—“In order that they may be accustomed to the changes made in the appearance of the several objects under altered conditions.”

Q. 364.—What is the instructor opposite to the 50 yards point to indicate to the men of his squad?

A.—“The different parts of the figure, arms, accoutrements, and dress, which can be distinctly perceived on the soldier before him, also those parts that can no longer be perceived clearly at 50 yards.”

Q. 365.—What will the instructor then do?

A.—He will “question each man on the observations made on what he can see, and enjoin him to try and impress upon his mind the appearance of a man

at this distance, and pass the squad on to the next station."

Q. 366.—What is the instructor opposite the 300 yards point to direct the men's attention to?

A.—"To those parts of the figure, dress, and equipments which are distinctly perceptible, and those that are seen less clearly, mentioning those that are not visible."

Q. 367.—What should be the strength of a squad at judging distance drill?

A.—"At least double the number of men employed as 'points.'"

Q. 368.—Why is it laid down that the squad should consist of at least double the number of men employed as points?

A.—"In order that 'the men who are placed as 'points' may be relieved by others who have made their observations."

Q. 369.—How may points be thrown out when the party is very large?

A.—"To the right and left, or in opposite directions."

Q. 370.—For what purpose are points thrown out in opposite directions?

A.—"In order to afford a view of the men at the several distances in two aspects."

Q. 371.—What will be done when all the men have made their observations?

A.—"The squad or party will be marched to a 'different ground from that on which the drill on fixed points has taken place, and the instructor will place a man, standing at ease, at any unknown distance within 300 yards, opposite to, but if possible unobserved by the squad."

Q. 372.—What is the instructor then to caution the men to do?

A.—"To recollect the appearance of the men just seen at known distances."

Q. 373.—How will the squad instructors stand with reference to their respective squads?

A.—"Three paces to the front of the right of their squads."

Q. 374.—How are the men to give their answers?

A.—"In a division of five yards, and in a low tone of voice."

Q. 375.—Why are the men of the squad called separately to the front to give their answers, and why are they cautioned to give them in a low tone of voice?

A.—In order that their answers may not influence the opinion of the other men of the squad.

Q. 376.—Are the men allowed to converse with one another?

A.—No, not while the answers are being given.

Q. 377.—What are the instructors to do when all the men have given their answers?

A.—They are to read over the answers to their squads.

Q. 378.—Why are the instructors to read over the answers to the men?

A.—In order to discover whether they have been correctly entered, and also to make any alteration necessary before the correct distance is given out.

Q. 379.—How will the correct distance be determined at judging distance drill?

A.—By the stadiometer or by pacing.

Q. 380.—Where will the instructor place himself when the squad has to pace the distance?

A.—In front of the centre of the squad.

Q. 381.—How many paces equal 100 yards?

A.—120.

Q. 382.—How may time be saved in finding the correct distance, when there is no stadiometer?

A.—"The party may be separated into two equal portions, moved in different directions, and when halted, turned towards each other, throwing out a file on the flanks a few paces off. After every man has judged, the parties are to advance towards each other, counting the paces as before."

Q. 383.—How will the correct distance in this case be determined?

A.—By adding together the number of paces each party has marched.

Q. 384.—What is the instructor to be careful about in conducting these exercises?

A.—“That they are conducted as much as possible in different directions, and under different states of the atmosphere,”

Q. 385.—Why?

A.—“In order that the soldier may become habituated to the diversity of circumstances in which he may have to act.”

Q. 386.—Of what is every judging distance drill to consist?

A.—“Of observations made on men placed at known distances, and of three answers given on men placed at unknown distances, in different situations, immediately afterwards.”

Q. 387.—What will be done in the case of a young officer, recruit, or drilled soldier, becoming a casual during his preliminary drills, and not making them up before the annual returns are completed?

A.—He will be considered as not having been exercised, and reported accordingly.

PART V.

PRACTICE.

1. BALL FIRING.

Q. 388.—Whose presence is necessary on a range before firing can take place?

A.—The presence of an officer.

Q. 389.—What does target practice afford a proof of?

A.—“The attention bestowed on the preliminary drills; the more carefully they have been performed, the better will be the results.”

Q. 390.—How many targets are allowed for a battalion?

A.—Eight.

Q. 391.—What are the dimensions of a target?

A.—“Six feet in height and two in breadth, and of sufficient thickness to be bullet proof.”

Q. 392.—For what purpose are the targets marked off into squares of six inches?

A.—“To facilitate the marking off of the hits on the diagrams provided for experimental purposes, and to serve as guides in painting the bull’s-eye and centre.”

Q. 393.—How are targets to be coloured?

A.—White, with a mixture of whiting, water, and size.

Q. 394.—How are the bull’s eye and lines describing the centre to be coloured?

A.—“Black, with lamp-black, water, and size.”

Q. 395.—How are targets to stand when in use?

A.—“On platforms erected for the purpose, and as perpendicular as possible.

Q. 396.—Why is the greatest care to be taken in lowering and raising targets?

A.—“To prevent their being damaged.”

Q. 397.—How should targets be placed when not in use?

A.—“At an incline, face upwards, to prevent the rain lodging on them.”

Q. 398.—How are they to be preserved from the effects of exposure?

A.—“They are to be painted periodically.”

Q. 399.—What is to be done in the event of a target becoming unserviceable?

A.—“It will be exchanged in the manner prescribed for other stores.”

Q. 400.—For what purpose is a fatigue party to be detailed daily during the annual course?

A.—(1) “For the purpose of fixing and cleaning the targets.”

(2) “Assisting to signal shots.”

(3) “As look-out men to warn persons from crossing the range while firing is going on.”

(4) “For any duties that may be required during the practice.”

Q. 401.—Of what is this fatigue party to consist?

A.—“Of at least six men (one of whom is to be a pioneer) in charge of a non-commissioned officer.”

Q. 402.—Under whose orders is this fatigue party to be?

A.—“Under the orders of the instructor of musketry.”

Q. 403.—How are hits on the target to be indicated?

A.—By discs on dummy targets erected above and in front of the marker's butt or mantlet; or at stations where Bland's markers' butts are constructed, by discs placed in front of the hit on the target.

Q. 404.—How are ricochets and misses indicated?

A.—By flags.

Q. 405.—How are the various shots signalled?

A.—Outer. “Black disc, which is to be first shown at one side of the target, and then over the spot on the dummy which represents the hit on the target.”

Centre. “Black disc, which is to be placed *at once* over the spot on the dummy which represents the hit on the target.”

Bull's-eye. “White disc placed over the bull's-eye.”

Miss. “Red and white flag.”

Ricochet. “Red flag waved horizontally twice to and fro in front of the target.”

Q. 406.—Which side is the disc to be first shown in signalling an outer?

A.—That side which is best suited to the range.

Q. 407.—How will a marker signal a miss when he is unable to determine in which direction the shot has gone?

A.—“He will wave the miss signal twice to and fro above the butt or mantlet.”

Q. 408.—How are ricochets noted in the register?

A.—By the letter R.

Q. 409.—What is invariably to be the signal used for danger, or for cease firing?

A.—A red flag.

Q. 410.—Detail briefly the orders relating to the red or danger flag.

A.—The red flag is always to be hoisted on the signal staff before any firing takes place.

“No man is on any account to leave the marker’s butt until the danger flag is raised, at the firing point, in answer to the danger signal.”

“The red flag is always to be kept up as long as the markers are out of the butt, or any person is in the line of range.”

“Whenever the danger flag is raised at the firing point, it is to be immediately answered from the marker’s butt.”

“The danger flag is to be lowered on the ‘fire’ sounding.”

“On no account is a shot to be fired when the danger signal is up at the marker’s butt.”

Q. 411.—What is a shot to be counted when the circumference of the mark made by the bullet, cuts the outer edge of the bull’s-eye or centre?

A.—“Whenever a bullet strikes the target, so that the circumference of the mark cuts the outer edge of the bull’s-eye or centre, such shot is to be counted, in all practices, as hitting the bull’s-eye or centre, as the case may be.”

Q. 412.—What is a fair hit?

A.—“When the mark of the bullet, part or whole, is seen on the face of the target.”

Q. 413.—Who is the marker in the butt invariably to be?

A.—“ A full non-commissioned officer (if possible a sergeant) of a different company from that engaged in firing.”

Q. 414.—For what is the marker in the butt responsible ?

A.—“ That the correct signals are given to the several shots which strike the target.”

Q. 415.—What memorandum is he to keep ?

A.—“ A memorandum under the head of bull's-eyes, centres, outers, ricochets, and misses.”

Q. 416.—For what purpose is he to keep this memorandum ?

A.—“ To facilitate the marking, and ensure each man's shot receiving the correct signal.”

Q. 417.—In what strength are the firing parties to be marched to the practice ground ?

A.—“ In squads of not more than twenty men each, and only one squad at a time for each range available.”

Q. 418.—What arrangements are to be made in order to prevent delay ?

A.—“ Such detailed arrangements as will ensure the relieving squads arriving on the practice ground by the time the parties firing have finished their practice.”

Q. 419.—Which class will have the choice of time for practice ?

A.—“ The senior class.”

Q. 420.—In what forms, and in what order are the men's names to be entered.

A.—“ In a register of the form marked C, or summary of the form marked E, in the order in which they appear in the drill and practice return, and according to which they are to stand in the ranks.”

Q. 421.—When are the men's names to be entered in the registers and summaries ?

A.—“ Before going to the practice ground.”

Q. 422.—For how many distances can a register be used ?

A.—“ Two distances.”

Q. 423.—Who is to keep the register ?

A.—“An officer if possible (if not, a non-commissioned officer).”

Q. 424.—What are the duties of the register keeper?

A.—“He is to note in the register opposite each man's name (which he is to call out before he fires) the number of points obtained by each shot, notifying also the result of the shot to the man.”

Q. 425.—How, and when, are all the entries to be made?

A.—“In ink, on the practice ground.”

Q. 426.—How are any alterations in the entries to be made?

A.—“A fine line is to be drawn through the letter or figure and the correction made, the initials of the company officer being immediately attached to it to verify the circumstance.”

Q. 427.—How will inattention to this regulation, or an erasure, affect the register?

A.—It will invalidate the entry.

Q. 428.—Is an erasure ever to be made in a register?

A.—No, it is prohibited.

Q. 429.—On which flank of the firing party is the bugler to stand?

A.—On the right.

Q. 430.—In what order will the men fire?

A.—In succession, commencing from the right of the front rank, and afterwards from the right of the rear rank.

Q. 431.—What will a man do as soon as he has fired his shot?

A.—He will order arms, and wait until his shot is signalled.

Q. 432.—What will he do as soon as his shot has been signalled?

A.—“He will move by the right flank and form three paces in rear of the front he formerly occupied.”

Q. 433.—When will the next man to fire step forward and get into position?

A.—“Immediately the man on his right has fired.”

Q. 434.—When will he come to the present?

A.—“Not until the former man’s shot has been signalled.”

Q. 435.—May the firing ever commence from a named man of the squad?

A.—Yes, the men firing in the same order.

Q. 436.—When will men be allowed to come to the front by two at a time?

A.—When the firing is in ‘any position.’

Q. 437.—How will they deliver their fire in this case?

A.—“Alternately, without being removed, until the whole number of rounds has been expended.”

Q. 438.—Why is the officer (or instructor) to be cautious not to check a man for any error at the time he is firing?

A.—“Because it would have the effect of distracting his attention from the object he is aiming at.”

Q. 439.—When is a man to be corrected, if any error should be noticed?

A.—“After he has fired.”

Q. 440.—What is to be done when the hits on the target become too numerous for the marker to distinguish the new ones as they strike?

A.—The firing is to cease, and the target is to be recoloured.

Q. 441.—What is the captain or officer of the section to do before the target is recoloured?

A.—He is, with the marker, “carefully to compare the register with the target to see that they agree, and he is to satisfy himself that the target is properly cleaned, and all the old shots obliterated, before the practice is resumed.”

Q. 442.—What is to be done at the conclusion of the practice by a section at a distance?

A.—“The points obtained by each man are to be totalled and read out, after which the bugler is to sound the ‘cease fire’ and the ‘advance,’ when the officer of the section is to proceed to the target, and with the marker, compare the register therewith.”

Q. 443.—What is the officer to do if he discovers any difference between the number of hits noted in his register and those found on the target?

A.—He will add or deduct any difference that may be discovered, from the total points.

Q. 444.—May any hits found on the target, which have not been noted in the register, be credited to any one of the squad?

A.—No.

Q. 445.—When must every correction, which a soldier may claim in his score, be made?

A.—“Before another shot is fired.”

Q. 446.—Who signs a register at the conclusion of the day’s practice?

A.—The marker, and the officer superintending the practice.

Q. 447.—What is then done with the ‘duplicate total points’?

A.—“The duplicate total points, corresponding with the practices executed, are to be initialed by the officer-instructor or his assistant, to verify their agreement with the column total points, and then torn off and handed to the officer-instructor or his assistant on the practice ground.”

Q. 448.—Who is responsible that this order referring to the initialing and removing ‘the duplicate total points’ is attended to?

A.—The officer-instructor.

Q. 449.—Who signs the practice register in the case of recruits?

A.—The sergeant, or squad instructor who kept it, the marker, and the officer-instructor or his assistant.

Q. 450.—Who is invariably to superintend the practice of recruits?

A.—The officer-instructor or his assistant.

Q. 451.—Is the 'duplicate total points' torn off in this case?

A.—No.

Q. 452.—Why not?

A.—Because the officer-instructor retains possession of the registers.

Q. 453.—Where is the cause of absence of any men whose names are in the register, and who have not practiced, to be stated?

A.—In the columns 'total points' and 'duplicate total points.'

Q. 454.—In what form and by whom are the total points obtained by each man, per register, to be entered?

A.—In the company Drill and Practice Return, by the company instructor.

Q. 455.—When are these entries to be made?

A.—"Immediately on his return to barracks."

Q. 456.—By whom are the performances of recruits entered?

A.—"By the sergeant-instructor."

Q. 457.—When may a man, who has fired at one distance in a class, and has been unable to continue it with his company, be allowed to complete such a class?

A.—"Before the termination of the annual course."

Q. 458.—How is he to be classified, if he is unable to complete it?

A.—"According to the number of points he has obtained."

Q. 459.—Is he included in the number by which the total points are divided, to determine the merit of the shooting of the class in question?

A.—Yes.

Q. 460.—A man fires five rounds at a distance, and is unable to complete the practice owing to sudden illness; is he considered as having fired at this distance?

A.—No, "not unless the points he has obtained pass him into a higher class."

Q. 461.—What is to be done in the event of the squad or section being prevented by heavy rain from finishing the practice?

A.—"The shots already fired are to be compared; the points obtained being totalled and initialed by the officer superintending the practice."

Q. 462.—When is the officer-instructor to compare the duplicate total points with the entries made in the Drill and Practice Return?

A.—At the conclusion of every class.

Q. 463.—What are the orders relating to persons watching the firing?

A.—They are to stand to the right of the firing point, and clear of the firing party; and on no account is any noise or talking with the men to be allowed.

Q. 464.—How many rounds is each drilled soldier and recruit to expend annually?

A.—Ninety rounds.

Q. 465.—How are these rounds to be expended in the case of the drilled soldier?

A.—"60 in individual firing.

5 in volley.

5 in independent firing, and

20 in skirmishing order."

Q. 466.—How are these rounds to be expended by the recruit, in his training?

A.—60 in individual firing.

10 in volley.

10 in independent firing, and

10 in skirmishing order.

Q. 467.—What are the dimensions of the targets, and the size of the bull's-eyes and centres, for each class?

A.—1st class target 6 ft. \times 8 ft. (or four targets).

Bull's-eye .. 3 ft. diameter.

Centre .. 5 ft. diameter.

2nd class target 6 ft. \times 6 ft. (or three targets).

Bull's-eye .. 2 ft. diameter.

Centre .. 4 ft. diameter.

3rd class target 6 ft. \times 4 ft. (or two targets).

Bull's-eye .. 1 ft. diameter.

Centre .. 3 ft. diameter.

Q. 468.—What is the 'Outer' to be in all cases?

A.—The remainder of the target outside the line describing the centre.

Q. 469.—At what distances, and in what positions, is the recruit to fire in the several classes of individual firing?

A.—1st class .. 500 and 600 yds., lying down.

2nd class .. 300 and 400 yds., kneeling.

3rd class .. 100 and 200 yds., standing.

Q. 470.—How many rounds is the recruit to expend at each of the above distances?

A.—Ten rounds.

Q. 471.—At what distances, and in what positions, is the drilled soldier to expend his 60 rounds in individual firing?

A.—1st class .. 700 and 800 yds., any position.

2nd class .. 500 and 600 yds., any position.

3rd class .. { 200 yds., standing.
300 yds., kneeling.

Q. 472.—What is the width of the line defining the centre?

A.—Half an inch.

Q. 473.—Is the soldier allowed to make use of artificial rests at individual firing?

A.—No.

Q. 474.—In whose favour is an exception made to the rule about the kneeling position?

A.—“An exception in favour of old officers and of soldiers of cavalry, who may, with the sanction of their commanding officer, fire standing at distances beyond 300 yards.”

Q. 475.—What exception is there to the rule about the pack being worn at the volley and independent practices?

A.—It is not to be worn in tropical climates at these practices.

Q. 476.—Under what circumstances are soldiers allowed to fire from the left shoulder?

A.—“When certified by the medical officer to be suffering from defective vision of the right eye.”

Q. 477.—Does this exception extend to the volley and independent practices?

A.—No.

Q. 478.—By whom is the bar of the back sight to be reversed, should the soldier wish to use the bar instead of the notch?

A.—By the armourer-sergeant.

Q. 479.—When are young officers and recruits allowed to fire ball?

A.—“Not until they have been exercised through the prescribed number of preliminary drills.”

Q. 480.—Does this rule apply also to drilled soldiers before they fire their annual allowance of practice ammunition?

A.—Yes.

Q. 481.—What exception is there to this rule in the case of the drilled soldier?

A.—“First-class shots and first-class judges of distance, if excused by the commanding officer.”

Q. 482.—How many points must the soldier obtain with the Martini-Henry rifle in individual firing to pass from one class to another?

A.—To pass into the 2nd class .. 80 points.

To pass into the 1st class .. 120 points.

Q. 483.—How is the drilled soldier classified?

A.—According to the points he obtains in the three classes of individual firing.

Q. 484.—What is the classification for the drilled soldier?

A.—120 points and upwards .. 1st class.

80 to 119 points 2nd class.

Under 80 points 3rd class.

Q. 485.—How many points must a recruit obtain before he is qualified to fire with his company and compete for prizes?

A.—70 points.

Q. 486.—What will be done in the case of recruits who fail to obtain an aggregate total of 70 points?

A.—“They will be annually exercised by the officer-instructor through a course of preliminary drill as for the recruit, and practice as for the drilled soldier, until, by obtaining 70 points and upwards in individual firing, they qualify to fire with their companies and compete for prizes.”

Q. 487.—How will those recruits be classified who fail to obtain an aggregate total of 70 points in the individual firing?

A.—As third-class shots.

Q. 488.—Are their performances included in calculating the battalion figure of merit?

A.—Yes.

Q. 489.—How many points must a man obtain in order to qualify as a marksman?

A.—130 points in the three classes of individual firing.

Q. 490.—At what distance is the volley firing performed?

A.—At 300 yards.

Q. 491.—How many rounds are expended by the drilled soldier, and how many by the recruit in volley firing?

A.—The drilled soldier expends five rounds, the recruit ten.

Q. 492.—What difference is there in the way the volley and independent firing is performed with the Martini-Henry and with the Snider rifles?

A.—Only the front rank kneels with the Martini-Henry rifle, while with the Snider the volley and independent firing is performed both ranks kneeling.

Q. 493.—What are the dimensions of the target used at the volley and independent practices?

A.—6 ft. \times 12 ft. (or six targets).

Q. 494.—How is this target to be coloured?

A.—A black mark 2 feet deep is to be painted across the centre.

Q. 495.—What hits are to be counted in these practices?

A.—“All fair hits and ricochets (but not hits by fragments of bullets).”

Q. 496.—What is the value of each hit?

A.—Two points.

Q. 497.—What is to be the strength of a squad firing in these practices?

A.—“As large as possible, but it is not to exceed twenty or to be less than five men.”

Q. 498.—If a man's rifle miss fire, is he to be allowed to fire singly at the target after the volley has been delivered?

A.—No.

Q. 499.—How are miss-fires in a volley to be counted?

A.—As rounds expended.

Q. 500.—May a man be withdrawn from the practice after having commenced it?

A.—No.

Q. 501.—How is the merit of the practice to be ascertained in the volley and independent firing?

A.—“By dividing the number of points (obtained by the hits on the target) by the number of men in the squad.”

Q. 502.—Is the time, in the volley firing, taken from any particular man of the squad?

A.—No, each man is to rest three pauses of slow time.

Q. 503.—What is the instructor to notice at the skirmishing practice as regards casualties who have not fired beyond 300 yards?

A.—“That they adjust their sights to the proper elevation.”

Q. 504.—How many rounds are expended by the recruit and drilled soldier in the independent firing?

A.—The recruit expends ten rounds, the drilled soldier five.

Q. 505.—At what distance is the independent firing to be executed?

A.—At 300 yards.

Q. 506.—How many rounds are expended by the recruit and drilled soldier in the skirmishing practices?

A.—Recruit ten rounds, drilled soldier twenty.

Q. 507.—At what distances does the recruit execute his skirmishing practice?

A.—“Advancing from 400 to 200 yards, and retiring from 200 to 400 yards, until the ammunition is expended, each man judging his own distance and arranging his sights accordingly.”

Q. 508.—At what distances does the drilled soldier execute this practice?

A.—Advancing from 500 or 600 to 200 yards, and retiring from 200 to 500 or 600 yards.

Q. 509.—What are the dimensions of a target for the skirmishing practice?

A.—2 feet \times 6 feet (one target laid on its side).

Q. 510.—How is this target to be coloured?

A.—“With a black mark 2 feet square across the centre.”

Q. 511.—How many men are to fire at each target?

A.—Two.

Q. 512.—How far is the rear-rank man to be from his front-rank man?

A.—One pace, and in the same alignment.

Q. 513.—When are the men to load?

A.—“Not until they are in position, with their front clear, whether advancing or retiring.”

Q. 514.—For what purpose is a sentry to be placed on each flank of the extended targets?

A.—“To prevent any person approaching.”

Q. 515.—Who is this sentry to be, and how far from the extended targets is he to stand?

A.—“One of the fatigue party, about forty or fifty yards off.”

Q. 516.—What is it the duty of the company officer

to ascertain before commencing any of the above practices?

A.—That the names entered in the summary are those of the men composing the squad.

Q. 517.—What is to be done at the conclusion of the firing?

A.—“The company instructor, accompanied by a non-commissioned officer of another company, is to go to the targets and take off the hits on a summary, in the presence of the officer commanding the company.”

Q. 518.—What is to be done when the summary is completed?

A.—“It is to be compared with the target, and then signed by the company instructor and the non-commissioned officer of another company who witnessed the hits being taken off, and countersigned by the officer commanding the company.”

Q. 519.—In what return are the points obtained by each section to be entered?

A.—“In the columns set apart for the purpose in the drill and practice return.”

Q. 520.—When are the volley, independent, and skirmishing practices to be executed?

A.—“Not until after the completion of the individual firing.”

Q. 521.—In whose case is an exception made to this rule?

A.—“In the case of a drilled soldier who, having become a casual after the termination of the third class, may be available to perform these practices with his company before he completes the other periods.”

Q. 522.—Is a man allowed to fire in the 1st class before he has completed the 2nd and 3rd classes in individual firing?

A.—No.

Q. 523.—Through what course are men who remain in the third class at the final classification to be exercised?

A.—“Through a course of aiming and position drills and blank firing, in every respect as for recruits; and are afterwards to fire through the first period, when the practice range is so situated as not to entail their being detached from head-quarters.”

Q. 524.—Is this additional practice to be suffered to deprive a soldier of his furlough?

A.—No.

Q. 525.—In what return are the performances of such men to be entered?

A.—In a recruit's practice return, set apart for the purpose, and headed “3rd class shots at final classification.”

Q. 526.—How is the figure of merit determined, to measure the efficiency of the shooting of a company or battalion?

A.—“The figure of merit is determined by the average of the individual firing, the total points obtained being divided by the number of men who commenced practice at 200 yards, including any men who cannot see up to that distance.”

Q. 527.—“How is a tie between two companies, making the same number of points in the individual firing, to be decided?”

A.—That company making the greatest average number of points at 800 yards, and if still a tie, at 700 yards (and so on), is to be considered the best.”

Q. 528.—What will be the strength of the squad for independent firing before the inspecting officer?

A.—Ten men.

Q. 529.—How will these ten men be selected?

A.—“Indiscriminately from the several companies on parade.”

Q. 530.—How many rounds will they fire?

A.—Ten rounds.

Q. 531.—In what documents is the result of their performance noted?

A.—“The result, in percentage of hits and average

points, is to be notified in the inspecting officer's confidential report, and in the annual practice return."

Q. 532.—What is the Inspector-General to note in his annual report with regard to these practices?

A.—"Any deficiency he may observe."

Q. 533.—In what case is no ammunition to be demanded?

A.—"When the practice range does not extend to 300 yards."

Q. 534.—Are the preliminary drills to be executed in this case?

A.—Yes.

Q. 535.—For what purpose are certain orders laid down, "to be observed on rifle ranges"?

A.—To prevent the possibility of accidents.

Q. 536.—Whose sanction must be first obtained before any alteration, thought advisable from local circumstances, is made in these rules?

A.—"The general officer's commanding the district, division, or station."

Q. 537.—To whom is the general to communicate the fact if he sanctions these alterations?

A.—"To the Adjutant-General for the information of the Commander-in-Chief."

Q. 538.—Detail briefly the orders for the senior officer at the firing point.

A.—(1) That all the rules and regulations regarding the use of the red flag are observed.

(2) "Not to allow any man to fire until the shot of the previous man has been signalled."

(3) "On ranges situated in pairs the parties are to fire by classes, at the same distances, and not one class in front of the other."

(4) "When the 'cease fire' sounds, the firing at both ranges (occupied in pairs) is to be discontinued until the 'fire' is again sounded."

- (5) To see that all persons watching the practice stand to the right and clear of the firing party.
- (6) "To allow no irregularity, to see that the men keep their places in the ranks, and to be alert to prevent accidents."

Q. 539.—Detail briefly the orders for the non-commissioned officer marking in the butt.

- A.**—(1) To see that all the rules and regulations regarding the use of the red flag are attended to.
- (2) To see that the proper discs and flags are used to signal the several shots.
 - (3) To allow no man to leave the butt until the 'cease fire' is sounded at the firing point in answer to the danger signal.
 - (4) "To allow no person to enter the butt except on duty, without an order from the senior officer on the range, nor to allow anyone to leave or enter the butt except by the regular path."
 - (5) "To check all noise or talking in the butt."
 - (6) "When the 1st and 2nd class shots are firing, to see that all persons in the butt stand as close as possible to the interior slope, to avoid the chance of being hit."

Q. 540.—What are the orders to be observed by look-out men?

- A.**—(1) "To look out carefully, and the instant any person appears coming towards the range to hoist his red flag, and call out to the non-commissioned officer in the marker's butt 'danger,' and to keep his flag up until the person has passed. The same precaution to be observed in respect to boats passing close in shore in the line of range."
- (2) "To give notice to all persons who are about to cross the range that they are in

danger while the firing is going on, and to signal them back."

(3) "To watch for the danger flag at the firing point, and directly it is hoisted to call out to the non-commissioned officer in the butt 'flag up.'"

(4) "In the performance of his duty (especially during the execution of the volley, independent, and skirmishing practices), to keep as low as possible."

Q. 541.—Is the attendance of a medical officer while target practice is going on necessary?

A.—No, except at certain stations.

Q. 542.—At what stations at home is the attendance of a medical officer at target practice necessary?

A.—Aldershot, Shorncliffe, Dover, Portsmouth, Plymouth, Milton for Gravesend, Dublin, and the Curragh.

Q. 543.—Under what circumstances is the actual presence of a medical officer on the range at these stations, unnecessary?

A.—"When the hospital or quarters of the medical officers so attending at these stations are within a mile from the ranges;" he is not, however, to leave his quarters while the practice is going on.

2. JUDGING DISTANCE PRACTICE.

Q. 544.—By whom is a course of judging distance practice to be gone through annually?

A.—"By recruits, drilled soldiers, and officers of companies."

Q. 545.—For what purpose are they to be put through this course of practice?

A.—“With a view to test the proficiency of the several companies in this essential exercise for the efficient and practical use of the rifle.”

Q. 546.—How is the correct distance to be ascertained in this exercise?

A.—By the stadiometer, a cord or chain, or by triangulation.

Q. 547.—Describe the cord or chain used at judging distance practice?

A.—It is divided into parts of five yards, and of the length required for the practice; the several divisions are to be so marked as to be distinguished only on close inspection.

Q. 548.—What are the points for the recruit to estimate the distance from, in judging distance practice?

A.—“One or more men, when judging to 300 yards only, beyond that distance a section of not less than eight or ten file.”

Q. 549.—What are the points for the drilled soldier?

A.—“Two or more men when judging to 500 yards, beyond that distance a section of not less than eight or ten file.”

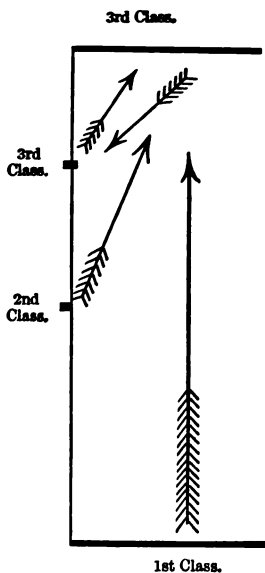
Q. 550.—Where are the men to be stationed when a cord or chain is used to ascertain the correct distance?

A.—“At the end, or at any other part of the chain that may be directed.”

Q. 551.—How can two or more classes judge distance together, when a cord or chain is used to ascertain the correct distance?

A.—By “a party of one of the classes being sent forward to the end, or any part, of the chain as ‘points’ from which the remainder of the class, as well as the other classes, are to judge their distance; the men of the party sent forward as ‘points’ at the same

time estimating their own distance from the class to which they belong." This diagram will illustrate how this method of executing the judging distance practice may be managed.



The arrows show points on which parties respectively judge.

Q. 552.—What memorandum is to be furnished to the N.C.O. in charge of the points, and the commander of each class, by the officer-instructor?

A. — "A memorandum specifying the distance at which the 'points' are to stand from the end of the chain for each answer, in order that they may each determine the correct distance."

SPECIMEN FORM OF MEMO.

Party.	Points.	Correct Distance.
50	600	550
105	815	710
200	875	675
70	900	830

Q. 553.—How is the correct distance in this case ascertained?

A.—"By deducting the distance at which the 'points' are stationed, from that at which the class is standing from the end of the chain."

Q. 554.—When is the correct distance to be ascertained by triangulation?

A.—"When there is no stadiometer, and the ground is so irregular or hilly as to prevent a chain or cord being used."

Q. 555.—By whom is a judging distance practice register to be kept?

A.—“By a sergeant or corporal, under the superintendence of an officer.”

Q. 556.—Are non-commissioned officers allowed to keep the registers containing their own names?

A.—No, not if it can be avoided.

Q. 557.—When are the number of points obtained by the men for each answer made known to them?

A.—As soon as the correct distance is given out.

Q. 558.—Is any alteration of an answer allowed after the correct distance is declared?

A.—No.

Q. 559.—How many answers are given by the soldier at each practice?

A.—Four.

Q. 560.—For what purpose is the officer-instructor to keep the column ‘duplicate total points’ of a judging distance practice register?

A.—To check the entries made in the Drill and Practice Return.

Q. 561.—When, and by whom, are these entries to be made?

A.—“By the company instructor, immediately on his return to barracks.”

Q. 562.—By whom is a judging distance practice register signed, in the case of recruits?

A.—“By the squad instructor, and countersigned by the officer-instructor or his assistant.”

Q. 563.—Is the duplicate total points to be torn off in this case?

A.—No.

Q. 564.—How many practices are there in a class of judging distance practice?

A.—Two.

Q. 565.—Between what distances does the drilled soldier judge in each class? *

* For recruits, see Appendix.

- A.—3rd Class .. Between 200 and 500 yds.
 2nd Class .. „ 505 and 900 yds.
 1st Class .. „ 200 and 900 yds.

Q. 566.—What are the value of the answers in each class? *

- A.—3rd Class .. { Within 15 yds., 2 points.
 { Within 30 yds., 1 point.
 2nd Class .. { Within 30 yds., 2 points.
 { Within 40 yds., 1 point.
 1st Class .. { According to the class the
 correct distance is in.

Q. 567.—How many distances, in the 1st class, must be over 500 yards?

A.—Four distances at least.

Q. 568.—How often should the 2nd or 1st class be brought to judge within the distance of an inferior class?

A.—“Not more than once in a practice.”

Q. 569.—For what purpose are the men brought to judge within the distance of an inferior class?

A.—To test their proficiency.

Q. 570.—How are their answers to be valued?

A.—“As detailed for the inferior class.”

Q. 571.—When will the classification of the men be made?

A.—When the three classes of judging distance practice have been completed.

Q. 572.—How are the men classified?

A.—According to the points they obtain in judging in the three classes. Men making 30 points and upwards will be classified as 1st class judges of distance.

Those obtaining 24 points but failing to obtain 30 points as 2nd class.

And those failing to obtain 24 points as 3rd class judges of distance.

Q. 573.—Who will be the best judge of distance in a company or battalion?

* For recruits, see Appendix.

A.—That man making the highest number of points in judging in the three classes together.

Q. 574.—How will ties in judging distance practice be decided?

A.—(1) By the points obtained in the 1st class.

(2) By the points obtained in the 2nd class.

(3) By the highest number of points obtained in the target practice.

(4) By target practice in the order laid down.

Q. 575.—How do you ascertain the best judging distance company?

A.—“The best judging distance company will be that company which obtains the highest average points in the three classes; the total points obtained being divided by the number of men who commenced the 3rd class, including the performances of the officers.”

Q. 576.—Are officers to be exercised in judging distance practice with their companies?

A.—No.

Q. 577.—How then will they be exercised?

A.—“Apart from their companies if in parties of any strength.”

Q. 578.—In what return are the names of the three best judges of distance, among the officers, notified?

A.—“In the annual practice return.”

Q. 579.—When are the three classes of judging distance practice to be executed?

A.—“Concurrently with the corresponding classes of target practice.”

Q. 580.—For what purpose are the men, when practicable, to be taken into the country by companies to be exercised in judging distance?

A.—“With a view to develop their powers in this branch of musketry training.”

Q. 581.—On what other occasions will the men be exercised in judging distance?

A.—“On marching out days, for which purpose the halts may be prolonged if necessary.”

Q. 582.—What indulgence is granted to the best judges of distance on these occasions?

A.—"They may be permitted to be absent from afternoon parade."

PART VI.

INSTRUCTIONS FOR THE USE OF THE STADIOMETER.

Q. 583.—How do you set up the instrument?

A.—"By placing the head of the index bar on the pivot of the tripod, and the end on the support."

Q. 584.—On what principle is this instrument constructed?

A.—"On the well-known mathematical proposition, that in similar triangles, similar sides are proportional."

Q. 585.—What is the length of the base, marked by the two flags, between which the men intended for 'points' are to stand?

A.—40 yards.

Q. 586.—At what angle is this base to the stadiometer?

A.—At right angles to it.

Q. 587.—How is this right angle determined?

A.—By means of the cross staff.

Q. 588.—What is the length of the index bar?

A.—60 inches.

Q. 589.—What is the length of the head of the bar?

A.—4 inches.

Q. 590.—How many sights are there on the head of the bar?

A.—Two.

Q. 591.—What is the distance between these two fore sights?

A.—2 inches.

Q. 592.—How many yards does every 4 inches of the index bar represent, when the outer of the two fore sights is used?

A.—40 yards.

Q. 593.—Up to what distance then can the outer of the two fore sights be used, and why?

A.—Up to 600 yards, because the scale on the index bar is only 5 feet.

Q. 594.—When is the inner fore sight used?

A.—When the distance is over 600 yards.

Q. 595.—How many yards does every 4 inches of the index bar represent, when the inner of the two fore sights is used?

A.—80 yards.

Q. 596.—What then must be done in reading off the distance in front of the movable back sight?

A.—The distance marked on the index bar must be doubled.

Q. 597.—How is the correct distance signalled to the party opposite to the stadiometer, when a class is divided “with a view to judge the distance from each other”?

A.—By means of a flag. When the flag is lowered to the right it will signify ‘hundreds’ of yards, to the left ‘tens,’ and to the front ‘five.’

Q. 598.—How would you signal 555 yards?

A.—By lowering the flag five times to the right to signify 500 yards, five times to the left for the 50 yards, and by dropping the flag to the front for the odd 5 yards.

Q. 599.—How is the correct distance from an object, such as a tree or a house, ascertained?

A.—(1) “Fix the cross-staff in the ground, and align it by means of one of the pairs of sights on the given object, the distance of which is required.”

- (2) "At 40 yards from the cross-staff, and to the left of it, place the stadiometer, the head of which is to be aligned by means of the other pair of sights attached to the cross-staff."
 - (3) "Push the slider until the outer fore sight is aligned on the object on which the cross-staff has already been aligned."
 - (4) "Look at the index bar and read off the distance."
-

PART VII.

PRIZES FOR GOOD SHOOTING.

Q. 600.—For what purpose are prizes for good shooting offered?

A.—In order to "stimulate individual exertion, and to reward the proficiency of soldiers in the use and management of the rifle."

Q. 601.—What is the 1st prize for target practice?

A.—"20*l.* and a silver medal, inscribed with the year in which won, and the winner's name, number, and regiment; to be worn on the right breast."

Q. 602.—To whom is the 1st prize given?

A.—"To the best shot of the infantry of the army (including the Royal Engineers and Colonial Corps) who have practised through the annual course of musketry drill and individual firing prescribed for the drilled soldier."

Q. 603.—What is the 2nd prize for target practice?

A.—"5*l.* and a badge of cross rifles and crown, worked in gold, to be worn on the left arm."

Q. 604.—To whom is the 2nd prize given?

A.—"To the best shot of every regiment, or battalion of infantry, consisting of not less than four companies, all of which must have been practised

through the annual course of musketry drill and individual firing as laid down."

Q. 605.—What is the 3rd prize for target practice?

A.—"2*l.* 10*s.* and a badge of cross rifles worked in gold, to be worn on the left arm."

Q. 606.—To whom is this prize given?

A.—"To the best shot of every company, in which forty men at least have practised through the annual course of musketry drill and individual firing as laid down."

Q. 607.—What modification is there of the 3rd prize, and to whom is it given?

A.—"2*l.* and a badge of cross rifles worked in gold, to be worn on the left arm, is given to the best shot of every depôt company in which thirty men at least have been practised through the annual course of musketry drill and individual firing as laid down."

Q. 608.—To whom is the 4th prize given?

A.—"To marksmen to the number of 10 per cent. of the men practised through the annual course of musketry as laid down, in each regiment or battalion, in addition to the holders of the 1st, 2nd, and 3rd prizes."

Q. 609.—What is the 4th prize for target practice?

A.—"1*l.* and a badge of cross rifles, worked in worsted, to be worn on the left arm."

Q. 610.—Can a soldier hold two of the above prizes for target practice?

A.—No.

Q. 611.—Who will succeed to the prize vacated by the winner of a higher prize?

A.—The second in order of merit.

Q. 612.—What qualification is necessary before a soldier can hold a prize for target practice?

A.—He must have qualified as a marksman.

Q. 613.—What honorary distinction is there in addition to the above prizes, and by whom is it worn?

A.—"A badge of cross rifles and crown, worked in gold, will be worn on the right arm by the sergeants of the best shooting company (in which forty men at

least have been exercised as laid down) in every battalion of infantry or dépôt battalion, and in the Royal Engineers, consisting of not less than four companies, all of which shall have passed through the annual course of practice, and shall have established a good average figure of merit; and those men who qualify as marksmen in the annual course, but who may be in excess of the percentage to whom prizes are allowed, will wear the distinctive badge of marksman."

Q. 614.—When will the prizes be issued?

A.—"As soon as the necessary authority shall be received at the corps."

Q. 615.—For how long, and from what date, will the badges be worn?

A.—"For one year, commencing from the first day of the month succeeding the receipt of such authority."

Q. 616.—How long will the badges be worn in the event of the drill and practice being suspended?

A.—"The badges may continue to be worn until the next award of prizes, after another annual course."

Q. 617.—How long may the winner of the first prize continue to wear the medal?

A.—During the remainder of his service.

Q. 618.—What becomes of a man's prize if he dies, deserts, or is transferred to another battalion?

A.—If the man dies his prize is credited in his non-effective accounts. If a man deserts he forfeits his prize. If he is transferred he takes his prize with him.

Q. 619.—A man who was in the guard room, and was thereby prevented from being exercised with his company, is exercised as a casual and obtains the highest number of points, in the three classes of firing, in his company; what prize does he receive, if any?

A.—He is not eligible to receive any prize.

Q. 620.—May a prize forfeited by one man be given to the next in order of merit?

A.—No, it may not.

Q. 621.—What becomes of the prize in such a case?

A.—It is forfeited altogether.

Q. 622.—For what fraction will additional prizes be given in calculating the number of men entitled to the fourth prize as marksmen?

A.—Fractions of six and upwards.

Q. 623.—How will prizes be awarded?

A.—On the aggregate number of points obtained in the three classes of individual firing.

Q. 624.—In a battalion 667 men are exercised through the annual course of musketry drill and individual firing in the order laid down, and 120 qualify as marksmen; how many men will receive the fourth prize?

A.—Sixty-seven.

Q. 625.—How many men of this battalion can receive prizes for good shooting?

A.—Seventy.

Q. 626.—Who will be the best shot of a battalion?

A.—“That man who, having obtained 130 points in shooting in the three classes, scores the greatest number of points in the three classes together.”

Q. 627.—Who will be the best shot in a company?

A.—“That man who, having obtained 130 points in shooting in the three classes, scores the greatest number of points in the three classes together.”

Q. 628.—How many prizes are given for judging distance?

A.—Two.

Q. 629.—What are these prizes, and to whom are they given?

A.—1*l.* to the best judge of distance in each company; and 10*s.* to 10 per cent. of each company exercised who obtain the greatest number of points in the three classes of judging distance practice, inclusive of the best judge of distance of each company.

Q. 630.—In a company 72 men are exercised through judging distance practice, and 11 qualify for prizes. State what, and how many prizes, the company obtains.

A.—The company receives seven prizes, viz. one

prize of 1*l.* to the best judge of distance in the company, and six prizes of 10*s.* to the next six men making the highest number of points in judging practice.

Q. 631.—How will ties in target practice be decided?

A.—(1) By the points obtained in the 1st class ; if there is still a tie, then

(2) By the points obtained in the 2nd class ; or if there is still a tie, then

(3) By the highest number of points obtained in the judging distance practice.

(4) By judging distance practice in the order laid down.

Q. 632.—What men will be eligible to receive judging distance prizes ?

A.—Men who obtain 30 points and upwards in judging in the three classes.

Q. 633.—How will ties in judging distance practice be decided ?

A.—(1) By the points obtained in the 1st class.

(2) By the points obtained in the 2nd class.

(3) By the highest number of points obtained in target practice.

(4) By target practice in the order laid down.

Q. 634.—Are men who qualify for prizes at the School of Musketry eligible for the rewards ?

A.—Yes, “provided they have not been exercised in the yearly course of practice before joining the said establishment.”

Q. 635.—What is to be done with the practice returns of men instructed at the School of Musketry ?

A.—They are to be sent to the officers commanding their battalions.

Q. 636.—In what cases will a sergeant wear two badges of cross rifles ?

A.—When he is “either the best shot of the battalion, the best shot of his company, or a marksman, he will wear the distinguishing badge of that position in addition to the honorary distinction.”

Q. 637.—When does a sergeant resign the honorary distinction ?

A.—When he leaves his company.

Q. 638.—What is to be the data upon which the proficiency of the men's shooting is to be estimated?

A.—The practice registers and summaries.

Q. 639.—Why are the practice registers and summaries to be the data upon which the proficiency of the men's shooting is estimated?

A.—“In order to ensure, on the one hand, a high rate of efficiency, and on the other, to guard against the public being called upon to pay for a low standard of merit, as well as to secure the utmost impartiality in the distribution of the rewards.”

Q. 640.—In what cases will the rewards not be charged against the public?

A.—If any irregularities should be detected in the registers or summaries, such as erasures, corrections not initialed by an officer, absence of the signature either of the marker or company officer, or loss of documents.

Q. 641.—Who will be required to make good any disallowances to the men in these cases?

A.—The responsible company officers.

Q. 642.—In what cases will all prizes be forfeited?

A.—When irregularities are discovered in the execution of the target and judging distance practices, “such as counting ricochets, placing marks to aim at, firing at distances shorter than enjoined by the regulations, or at a greater number of targets than are prescribed for the several distances, or at larger bull's-eyes and centres than prescribed for the several classes, departing in any way from the rules clearly defined for conducting the volley, independent, and skirmishing practices, or otherwise deviating from the spirit of the regulations.”

Q. 643.—How will prizes for good shooting be issued to marksmen in brigade depôts?

A.—“According to their order of merit in the brigade, irrespective of the depôt to which they belong, at the rate of 10 per cent. of the number of men exercised in the annual course of practice.”

Q. 644.—How, and with what return, are applications for rewards for good shooting sent in?

A.—“On the prescribed forms, in duplicate, with the annual musketry practice return.”

Q. 645.—To whom are these applications sent?

A.—“To the Inspector-General of Musketry, by whom, after due examination, they will be forwarded, with his recommendation, to the Adjutant-General to the Forces.”

Q. 646.—Are captains of companies allowed to give rewards from their private funds to the best shots of their companies?

A.—No.

Q. 647.—Why is this practice prohibited?

A.—Because “the distinctions and attendant pecuniary advantages liberally granted by Government are considered sufficient to stimulate the soldier to attain skill in the use of his rifle.”

Q. 648.—Does this rule apply to divisional, brigade, or battalion rifle contests?

A.—No.

Q. 649.—May a soldier practise for or compete in any club or rifle contest, or have any target practice whatever other than the yearly allowances of 90 rounds, after the commencement of the preliminary drills by his company?

A.—No, not until his company has completed its annual course.

PART VIII.

RETURNS.

Q. 650.—What do the various returns record?

A.—“The performances of all men trained with a battalion, brigade dépôt, or company during the annual course, whether effective or otherwise on the dates the returns are prepared.”

FOR RECRUITS.

DRILL AND PRACTICE RETURN.—FORM B.

Q. 651.—What is this return to contain?

A.—“The names of young officers and recruits.”

Q. 652.—In what order are their names to be entered?

A.—“In the order they join the dépôt or battalion.”

Q. 653.—When, and where, is this to be obtained?

A.—“From the orderly room, at the end of each month.”

Q. 654.—Will a separate return be required for each dépôt in a brigade?

A.—No; “the recruits of each dépôt will be shown separately by dépôts in Form A.”

Q. 655.—Who is to ‘keep’ this return?

A.—“The sergeant-instructor, superintended by the officer-instructor.”

Q. 656.—What is this return to record?

A.—“When each recruit has concluded the preliminary drills, thus ‘concluded,’ the points he has obtained in the several periods in shooting and judging distance, the averages obtained by each squad in volley, independent, and skirmishing practices, and the figure of merit of the recruits trained between the 1st April and 31st March.”

Q. 657.—Where is the cause which has prevented the training of every recruit, who appears not to have been exercised, to be explained?

A.—“In the column of remarks.”

Q. 658.—When is this return closed?

A.—“On the 31st March in each year.”

Q. 659.—Whose performances are excluded when the return is closed?

A.—“The performances of all effective recruits not fully trained, and of transfers to another corps or battalion partly trained in individual firing.”

Q. 660.—Whose performances are included in the return ?

A.—“The performances of partly trained transfers received who have completed their training since transfer, and of men non-effective from other causes, whether fully trained or not.”

COMPANY OR TROOP RETURNS.

DRILL AND PRACTICE RETURNS.—FORM B.

Q. 661.—What is this return to contain ?

A.—“The names of every soldier borne on the strength of the company, without reference to where he is or how employed, on the date when the annual course commences.”

Q. 662.—Whose names are not entered in this return ?

A.—“The regimental staff-sergeants, lads incapable of bearing arms, and recruits who do not commence their training as drilled soldiers with their companies.”

Q. 663.—How are the names to be entered ?

A.—“By squads or sections, with the non-commissioned officers at the head, leaving two lines between each squad.”

Q. 664.—How are men's names to be entered who were not available when the company commenced its annual course, or who joined afterwards ?

A.—“After the last squad or section, leaving a space of two lines.”

Q. 665.—What does this return show ?

A.—“The points obtained by each soldier in the several periods in shooting and judging distance, the averages obtained by each squad or section in the volley, independent and skirmishing practices, and the figure of merit of the company, on the date the

return is closed. In the column headed preliminary drills 'concluded,' or excused, with the reason why."

Q. 666.—Where is the cause, which has prevented the training of any man, to be entered?

A.—In the column of remarks.

Q. 667.—Where are the points obtained in the mounted practice in cavalry regiments, to be entered?

A.—"In the column headed 'skirmishing.'"

Q. 668.—What is done with the men's points who have not completed the three classes of individual firing when they are transferred to, or received from, another corps?

A.—"In the former case their names and performances will be struck out of the return, and in the latter they will be inserted in the return of their new company."

Q. 669.—Where is the date of their transfer specified?

A.—In the column of remarks.

Q. 670.—With which corps or battalion do men who have been transferred from one battalion to another, after they have completed their individual firing, complete their volley, independent, and skirmishing practices?

A.—"With their new corps or battalion."

Q. 671.—In the figure of merit of which battalion are their points in the three classes of individual firing included?

A.—"In the figure of merit of the corps or battalion from which they have been transferred."

Q. 672.—Does this also apply to the recruit's return?

A.—Yes.

Q. 673.—When are the totals at the foot of the return to be inserted in ink?

A.—"Not until the annual practice returns are to be prepared."

Q. 674.—How are the entries in the tables record-

ing the volley, independent, and skirmishing practices, to be vouched?

A.—By separate summaries.

Q. 675.—Is there any exception to this?

A.—Yes, in the case of men trained at Hythe, and casuals.

Q. 676.—Who is held responsible that this return is always forthcoming, and is correct in every particular?

A.—The captain of the company.

Q. 677.—Why?

A.—“Because it is the record showing the efficiency of every soldier of the company in the use of his rifle.”

Q. 678.—What is to be entered against a man's name who has practised, and has not obtained any points?

A.—A cipher.

TARGET PRACTICE REGISTER.—FORM C.

Q. 679.—For how many distances can each one of these forms be used?

A.—Two distances.

Q. 680.—What does a Target Practice Register record?

A.—“The class, the number of targets used, the dates on which the practices took place, the distances fired at, and the result of each shot fired.”

Q. 681.—Whose signatures is this register to bear?

A.—The officer's superintending the practice, and the marker's.

Q. 682.—What has the officer to certify who signs the register?

A.—“That the practices were conducted according to regulation, that he examined the targets both before and after the firing at each distance took place, and that the points recorded were obtained by the men opposite whose names they appear, and are the

original entries made on the ground during the practice."

Q. 683.—What is to be done when the firing in a class is concluded?

A.—"The register is to be endorsed and filed."

Q. 684.—In what order are the names of the men entered?

A.—"In the order in which they appear in the drill and practice return, with the succession number prefixed."

Q. 685.—Under what conditions may the names of the men of a class of two or more squads or sections be entered in one register?

A.—"Provided the number does not exceed 20."

Q. 686.—Who is to prepare the registers of casualties?

A.—The sergeant-instructor.

Q. 687.—May the names of the men of different companies be entered in the same register?

A.—Yes.

Q. 688.—How, and when, are the performances of casualties to be supplied to the captains of the companies with which they are serving?

A.—On Form M, at the end of the course.

Q. 689.—In what return are their performances then entered?

A.—In the drill and practice return of the company to which they belong.

Q. 690.—Who is responsible for the safe keeping of the registers?

A.—Captains of companies.

Q. 691.—Who is to keep the registers of casualties?

A.—The officer-instructor.

Q. 692.—Whose leave is it necessary to obtain before the practice registers are torn up, or done away with?

A.—The Inspector-General.

Q. 693.—When, and by whom, is the "duplicate total points" to be torn off?

A.—On the practice-ground, by the officer-instructor or his assistant.

Q. 694.—What is to be done previous to the “duplicate total points” being torn off?

A.—It is to be initialed by the officer-instructor.

Q. 695.—Why is the officer-instructor to initial the columns “duplicate total points”?

A.—“To verify their correctness.”

Q. 696.—For what purpose, and for how long, does the officer-instructor retain possession of the “duplicate total points”?

A.—“To check the entries made in the drill and practice returns, until examined by an inspector of musketry.”

Q. 697.—May the officer-instructor have the companies’ practice registers in his possession, or send for them to check the entries in the drill and practice returns?

A.—“No, on no account.”

REGISTER OF JUDGING DISTANCE PRACTICE.—FORM D.

Q. 698.—For how many classes can one of these forms be used?

A.—For one class.

Q. 699.—What is it to record?

A.—“The period of practice (in the case of recruits), the class in which exercised, the object used to judge from, the date of the practice, the correct distances, the answers given, and the points obtained by each man.”

Q. 700.—By whom is this return signed?

A.—By the non-commissioned officer who kept it, and by the officer superintending the exercise.

Q. 701.—What does the officer who signs the register certify?

A.—“That he was present during the practice, that it was conducted in accordance with regulations, that the answers recorded were those given by the men

against whose names they appear, and are the original entries made on the practice-ground."

Q. 702.—Will copies of original registers be admitted as vouchers, in support of claims for prizes?

A.—No.

Q. 703.—Do the instructions respecting names, safe keeping, &c., &c., laid down for the target practice registers, apply to the judging distance practice registers also?

A.—Yes.

SUMMARIES FOR VOLLEY, INDEPENDENT, AND SKIRMISHING PRACTICES.—FORM E.

Q. 704.—What is a summary?

A.—A form showing the results and performances of the squads in the volley, independent, and skirmishing practices.

Q. 705.—What does it record?

A.—The results and performances of the squads in the three practices, the distance fired at, and the date of the practice.

Q. 706.—How are the names of the men entered?

A.—"With their succession numbers, on each form, and in the skirmishing practice they are to be entered opposite the target, recording their performances."

Q. 707.—Who is to sign the summary at the conclusion of the practice of each section?

A.—"The company instructor, the non-commissioned officer of another company who witnessed the hits being taken off, and the captain or company officer superintending the practice."

Q. 708.—What does the officer who signs the summary certify?

A.—"That he was present at the practice, that it was conducted according to regulation, that he saw the hits which were obtained by the men whose names were entered therein recorded on the summary, which

was closed in his presence before being taken from the practice-ground."

Q. 709.—What is the 'memorandum' of a summary?

A.—A memorandum of a summary corresponds to the duplicate total points in a register, and is used for the same purpose.

Q. 710.—Who keeps the summaries?

A.—The captains of companies.

Q. 711.—Who keeps them in the case of recruits and casuals?

A.—The officer-instructor.

Q. 712.—When are all the foregoing documents to be produced?

A.—At the periodical visits of the inspector of musketry.

Q. 713.—Who is to be present when these documents are examined by the inspector?

A.—The captain of the company, and the company instructor.

Q. 714.—To whose notice is any carelessness or irregularity in keeping these returns to be brought?

A.—To the notice of the commanding officer.

BATTALION RETURNS.

MONTHLY DIARY.—FORM F.

Q. 715.—What does the diary show?

A.—The monthly diary shows separately, under the heading of drilled soldiers and recruits, the number of each at drill and practice daily, the cause of suspension when such is the case, the stations of the several companies, with the results of their practices. The number completely exercised with and transferred to the battalion, the number of each under instruction, the number of each not exercised wholly or in part, the figure of merit of each, the number of marksmen; the place, distance, and extent of practice range.

Q. 716.—How, and by whom, is this return prepared?

A.—In duplicate by the sergeant-instructor, superintended by the officer-instructor.

Q. 717.—What is done with these two copies?

A.—One copy is transmitted to the inspector on or before the fourth day of every month, by the commanding officer, whether the course is proceeding or not; the other is to be inserted in the regimental return book.

Q. 718.—What is a recruit in a musketry sense?

A.—That man who had not commenced the prescribed course of target practice as a drilled soldier on the completion of the annual course for the current year.

Q. 719.—To whom does this not apply?

A.—“To men who, having served in the army for 10 years, may have taken their discharge and re-enlisted within 12 months.”

Q. 720.—What is to be done when the diary is not signed by the gazetted officer-instructor?

A.—“The cause of the omission is to be explained.”

Q. 721.—What is to be stated where a sergeant, who is not in possession of a certificate signed by the Inspector-General, is acting as sergeant-instructor?

A.—“Whether or not he has been trained at the school of musketry.”

ANNUAL PRACTICE RETURN.—FORM D.

Q. 722.—How, and by whom, is this return prepared?

A.—In duplicate by the sergeant-instructor, superintended by the officer-instructor.

Q. 723.—From what documents is it prepared?

A.—From the companies' drill and practice returns.

Q. 724.—What is done with the two copies of this return?

A.—One is sent to the inspecting general and the other to the Inspector-General.

Q. 725.—What is shown on the first page of the annual return?

A.—The dates on which the course commenced and terminated. The rifle with which, and the station at which the course was carried on. The number of men by companies, exclusive of transfers who had not completed their individual firing when transferred, but including transfers received under similar circumstances, with the results of their target practice, their figure of merit and final classification. The number of non-exercised men, the result of the independent firing in the presence of the inspecting officer. The place and extent of practice range. The best shooting company, and the best shot of the battalion, with his points. The strength of the battalion exclusive of recruits. In the column of remarks the differences in the number exercised in the three classes, and the volley, independent, and skirmishing practices, and the cause thereof.

Q. 726.—What is shown on the second page?

A.—The names of all marksmen, specifying the best shots of the battalion and of companies, and the cause of ineligibility of any man for the reward.

Q. 727.—What is shown in the column of remarks on the second page?

A.—The best shot of the battalion and of each company. The cause of men being ineligible for the reward, when such is the case. In the case of non-effective men, the date and cause of men becoming so. In the case of transfers, the corps to or from which transferred. When men are discharged abroad, whether they proceed to England or no. "Trained at Hythe" opposite marksmen who qualified there.

Q. 728.—What is shown on the third page?

A.—The names of the men making 30 points in judging distance practice, with their points; speci-

fyng the best of each company, and the cause of ineligibility, for the reward.

Q. 729.—What is shown in the column of remarks on the third page?

A.—The best judge of distance of the battalion, and of each company. The cause of men being ineligible for the reward, when such is the case.

Q. 730.—How are the men's names to be entered, who qualified in judging distance practice?

A.—By companies in order of merit.

Q. 731.—What is shown on the fourth page?

A.—The percentage of 1st class judges of distance. The number of men by companies with the result of their judging distance practice. The name of the best judge of distance among the men with his points in each class, and among the officers with his total points. A recapitulation table, showing the non-exercised men by companies, with the cause of their being so.

Q. 732.—What is the certificate at the end of the annual return, and by whom is it signed?

A.—The certificate is to the effect, "that the entries against the men's names agree with those in the registers; also that the entries in the companies' drill and practice returns agree with those in the registers and summaries." This certificate is signed by the commanding officer, and inspector if available; if not available, by the officer-instructor.

Q. 733.—When is this return to be transmitted to the Inspector-General?

A.—"As soon as the inspection is made, or in the case of battalions serving in the United Kingdom, North America, Australia, and the Cape of Good Hope, not later than the 14th November, and those serving elsewhere not later than the 15th May. The cavalry serving in the United Kingdom is to transmit this return to the Inspector-General of musketry not later than the 15th December."

Q. 734.—By whom is the annual return rendered?

A.—“By every corps, battalion, and brigade dépôt armed with the rifle or carbine, whether it has completed the prescribed yearly course of training or not.”

Q. 735.—What is to be done in the event of the course having been only partly executed?

A.—“A statement fully explaining the causes that have delayed or prevented the instruction is to accompany the return.”

Q. 736.—What certificate is forwarded by commanding officers with the annual return?

A.—“A certificate to the effect that the field officers have visited the drill and practice of the men frequently during the progress of the annual course, that the company officers were present with their companies during the whole time their companies were engaged in executing the annual course, and that all the orders on the subject have been observed.”

Q. 737.—What is to be done when the commanding officer is unable to supply this certificate?

A.—“The cause is to be fully explained.”

Q. 738.—By what is the annual return accompanied, when it is sent to the Inspector-General?

A.—“By an application for rewards for good shooting in duplicate.”

Q. 739.—What is to be entered in this application?

A.—“The names of the effective and non-effective men shown on pages 2 and 3 of the annual return, and in the same order.”

Q. 740.—Who fills in the columns in this application?

A.—The Inspector-General.

TRANSFER RETURN.—FORM M.

Q. 741.—What is Form M?

A.—A transfer return.

Q. 742.—When are the performances of men, transferred from one corps to another, not sent with them?

A.—“Their performances are not sent with them unless they have not completed their individual firing or are marksmen.”

Q. 743.—What is the object of this?

A.—“In order that in the former case they may receive credit in the practice return of their new companies with the points they have severally obtained, and that their instruction may be resumed; and in the latter case that their performances may be inserted in the list of marksmen in the annual return.”

Q. 744.—What form is to be made out in this case?

A.—“Form M is to be made out and forwarded to the battalion to which they are transferred.”

Q. 745.—What will be sufficient in other cases?

A.—“To notify to the commanding officer the extent to which the men transferred have been exercised, and their classification in the target and judging distance practices.”

Q. 746.—With which company are men in a battalion, who have been transferred from one company to another, to complete their course?

A.—With the company with which they commenced.

Q. 747.—In which company's drill and practice return are their performances to be included?

A.—In the drill and practice return of the company with which they commenced.

Q. 748.—How are transfers to Army Hospital Corps or other corps not armed with the rifle, to be treated?

A.—“As ‘discharged,’ and their performances included in calculating the figure of merit.”

Q. 749.—What is Form K?

A.—A district report.

Q. 750.—When, by whom, and to whom, is this report to be forwarded?

A.—On or before the 10th of each month, by inspectors, to the Inspector-General.

PART IX.

THE SELECTION, INSPECTION,
AND LAYING DOWN OF RIFLE RANGES.

Q. 751.—Why should officers be particularly careful in the survey of ground proposed for rifle ranges?

A.—“In order to protect the public from danger, to facilitate the acquisition of sites for the purpose, and to prevent unnecessary expense.”

Q. 752.—What is the minimum length of ground for a rifle range?

A.—300 yards.

Q. 753.—What is it most important to bear in mind in selecting sites for ranges?

A.—“That the ground behind the targets should be thoroughly commanded from certain points sufficiently clear of the line to ensure safety to the look-out men, in order that the firing may be easily stopped when necessary.”

Q. 754.—Why is a range down hill generally to be preferred to one up hill?

A.—Because it is more easily commanded.

Q. 755.—How are ranges to be established?

A.—In pairs.

Q. 756.—What is to be the interval between each range?

A.—“Not less than 10 yards.”

Q. 757.—What margin is to be allowed at the sides of a pair of ranges?

A.—At least 40 yards.

Q. 758.—What is the minimum breadth of ground for a pair of ranges?

A.—90 yards.

Q. 759.—What rules are to be observed in establishing two or more pairs of ranges on the same ground?

A.—“The targets are to be placed in the same line, with a space of 90 yards between the centre of one pair and that of another, and 40 yards at the sides of the outer ranges.”

Q. 760.—Why are these rules laid down?

A.—To prevent accidents, and in order that the men on each pair of ranges may fire independently.

Q. 761.—How may ranges be established when the number to be exercised is large, and the breadth of ground available for the purpose limited?

A.—“Three or four ranges may be established with an interval of 10 yards between each, to be worked or used as if a pair, with a margin at the sides of the outer ranges of at least 40 yards.”

Q. 762.—What should the breadth of ground be in rear of the targets, at each side of the outer ranges, when the ranges are parallel?

A.—The breadth of ground should gradually increase from 40 to 80 yards.

Q. 763.—How will the breadth required in rear of the targets vary when the ranges converge?

A.—“The breadth required as allowance for the divergence of the shots will vary according to the degree to which the ranges are made to converge.”

Q. 764.—What must the distances invariably be at the targets between ranges in pairs and between pairs of ranges?

A.—“The distances must never be less than 10 yards in the former and 80 yards in the latter case.”

Q. 765.—What should the distance be behind the targets on level ground?

A.—About 1500 yards.

Q. 766.—When will a less distance be required?

A.—When there is a steep hill in rear of the targets.

Q. 767.—What is it essential to secure before steps are taken to procure ground for ranges?

A.—“The right to fire over the land behind the targets to the extent required, should it not be desirable to purchase it.”

Q. 768.—What should the height of a butt be when the range is on a plain, and the distance behind the targets is less than 1500 yards?

A.—From 45 to 50 feet.

Q. 769.—What should the height of a butt be under ordinary circumstances?

A.—20 feet.

Q. 770.—What height will be sufficient when firing seaward?

A.—12 feet.

Q. 771.—At what angle should a hill be to be of use in stopping stray bullets, and so act as a natural butt?

A.—At least 45° .

Q. 772.—What would be the effect if the hill were at a smaller angle than this?

A.—“Instead of acting as a stop it would increase the chance of ricochet, and therefore be unsafe.”

Q. 773.—What is the minimum length of the butt for a pair of ranges?

A.—45 feet, measured along the top.

Q. 774.—What are the dimensions of a target platform?

A.—16 ft. \times 9 in.

Q. 775.—For what purpose are platforms always to be laid down?

A.—“To rest the targets upon, and to ensure their being at right angles to the line of range.”

Q. 776.—By whom is every range to be carefully and accurately measured?

A.—By an officer of the engineer department.

Q. 777.—At what intervals are the distances to be defined?

A.—“At every 50 yards, commencing at 100 yards from the targets, and continuing to 900 yards, or to the extent of the ground if under that distance.”

Q. 778.—Describe Bland's markers' butt.

A.—“A trench dug for the markers parallel with, and 10 feet in front of, the target platform, with a

seat so fixed that the marker may easily see, when sitting, the entire face of the target through the window of the trench."

Q. 779.—How are hits signalled where these markers' butts are used?

A.—By means of discs placed opposite to the position of the hits on the target.

Q. 780.—Are ricochet butts still in use?

A.—No.

Q. 781.—Why have ricochet butts been abolished?

A.—Because a ricochet can be distinguished in the marker's butt by the sound it makes passing through the air, and by the mark it makes on the target.

Q. 782.—Who is responsible that all ricochets are signalled?

A.—The marker.

Q. 783.—Describe the disc used to signal hits.

A.—"The disc, which is painted black one side and white the other, is fitted to a pole, flattened on each side, so as to rest against the small beam of the trench, and marked off by a broad black line into three parts of 2 feet each on both sides, commencing from the centre of the disc, which is to be let into a slit at the top of the pole."

Q. 784.—What form of marker's butt is to be used where the ground is such as to render it impossible to construct a butt on Bland's principle?

A.—Iron mantlets or screws.

Q. 785.—Where are these markers' mantlets to be placed?

A.—"15 yards to the front, and on one side of the target platform."

Q. 786.—How are hits signalled when mantlets are used?

A.—By means of discs placed in front of the position of each hit, on dummy targets erected above and in front of the mantlet.

Q. 787.—By whom is all work in the formation of practice ranges, &c., to be performed?

A.—“By fatigue labour of the troops, whenever the soil is such that it can be turned and moved with the ordinary entrenching tools.”

Q. 788.—By whom are the butts, ranges, &c., to be kept in repair?

A.—By fatigue parties from the regiments using them.

Q. 789.—Against whom are all charges for damages arising from carelessness or neglect to be made?

A.—Against the regiments responsible for the ranges.

PART X.

EXPERIMENTS WITH SMALL ARMS.

Q. 790.—How is the quality of arms, projectiles, and gunpowder, now represented?

A.—“By a figure showing the degree of concentration of a certain number of rounds fired.”

Q. 791.—What is this called?

A.—By any of the following terms:—“mean deviation,” “mean absolute deviation,” or “mean radial deviation.”

Q. 792.—How do you obtain the horizontal measurement?

A.—By measuring the distance of the centre of each hit from the left of the target.

Q. 793.—How do you obtain the vertical measurement?

A.—By measuring the distance of the centre of each hit from the bottom of the target.

Q. 794.—What are the mean horizontal and mean vertical measurements?

A.—The horizontal and vertical measurements added together separately, and divided by the number of HITS.

Q. 795.—What is the ‘point of mean impact’?

A.—The intersection of the lines showing the mean horizontal and mean vertical measurements.

Q. 796.—How do you obtain the absolute deviation?

A.—By measuring the distance of the centre of each hit from the point of mean impact.

Q. 797.—What do you allow as the absolute deviation for all misses?

A.—Half the diagonal of the target.

Q. 798.—How is the mean deviation determined?

A.—By adding together the absolute deviations, and dividing the sum by the number of ROUNDS fired; the quotient taken to two places of decimals will be the mean deviation.

Q. 799.—What does the distance from the point of mean impact to the point aimed at, denote?

A.—“The error due to wind and defective sighting.”

Q. 800.—By whom are arms to be examined and cleaned, previous to their being fired, for experimental purposes?

A.—“The arms are to be previously examined and cleaned by an armourer-sergeant, if available; if not, by some careful soldier.”

Q. 801.—Who is to be selected to fire the arms for experiment?

A.—“One of the best and steadiest shots in a battalion.”

Q. 802.—What examination is made of the ammunition to be used at the experiments?

A.—“The charges of powder are to be carefully weighed, and the ammunition properly examined.”

Q. 803.—May a rest be used in firing the rifle under experiment?

A.—“The firing is to be from the shoulder, with the aid of a table or other such rest.”

Q. 804.—At what distance is the firing to take place when trying rifles supposed to be defective?

A.—At 500 yards.

Q. 805.—What mean deviation is considered suffi-

cient to condemn a rifle, when the firing takes place at 500 yards?

A.—“A mean deviation of over 3 feet.”

Q. 806.—At how many distances is the firing to take place, when the trial is to determine the relative value of two or more rifles, projectiles, or description of powder?

A.—“At three distances at least.”

Q. 807.—What is to be the size of the target, if shooting at and under 600 yards?

A.—6 feet \times 8 feet.

Q. 808.—For what purpose are trial shots to be fired?

A.—To determine the position for the bull's-eye.

Q. 809.—Where should the bull's-eye be placed upon the target?

A.—“The bull's-eye should be so placed for aiming as to ensure all the shots, or as many as possible, being on the target.”

Q. 810.—Where is aim to be taken for each shot?

A.—At the bull's-eye fixed upon by the trial shots.

Q. 811.—How many shots is each diagram to record?

A.—Not less than 10, or more than 20 shots.

Q. 812.—Are trial shots included in the table of calculation?

A.—No.

Q. 813.—Are misses included?

A.—Yes.

Q. 814.—How are shots fired for a diagram to be numbered?

A.—“Consecutively from 1.”

Q. 815.—How are the hits on the diagram to be denoted?

A.—“By their respective numbers.”

Q. 816.—How are the shots which miss the target shown?

A.—“As such opposite their number in the table of calculation.”

Q. 817.—What does a diagram record?

A.—“(1) The name of the firer. (2) The distance fired at. (3) The number of rounds fired. (4) The object of the trial. (5) The description of arm, projectile, and powder under trial. (6) The weight of the charge and the bullet. (7) The strength and direction of the wind. (8) The state of the thermometer, and the barometer. (9) The state of the loading as affected by fouling; with any other information which may be considered necessary.”

APPENDIX.

DETAIL OF PRACTICES FOR RECRUITS.

Days.	Target Practices.									Judging Distance Practices.		
	3rd Class.		2nd Class.		1st Class.		Volley firing. No. of rounds.	Independent firing. No. of rounds.	Skirmishing. No. of rounds.	1st period.	2nd period.	3rd period.
	Distances.	No. of rounds.	Distances.	No. of rounds.	Distances.	No. of rounds.						
9th	1	10	..	..	..	..	..	..	..	1	..	..
10th	1	10	..	..	..	..	..	..	..	1	..	..
11th	..	..	1	10	..	..	..	..	..	..	1	..
12th	..	..	1	10	..	..	..	..	..	..	1	..
13th	..	..	..	..	1	10	..	..	..	..	..	1
14th	..	..	..	..	1	10	..	..	..	..	..	1
15th	..	..	..	..	..	..	10	10	..	..	..	..
16th	..	..	..	..	..	..	..	..	10	..	..	..

RECRUITS' TARGET PRACTICE.

Class.	Distances.	Position.	Targets.	No. of rounds at each distance.
3rd Class	100 and 200 yards	Standing	Two 6 feet \times 4 feet C. 3 feet B. 1 foot.	10
2nd Class	300 and 400 yards	Kneeling	Three 6 feet \times 6 feet C. 4 feet B. 2 feet.	10
1st Class	500 and 600 yards	Lying down.	Four 6 feet \times 8 feet C. 5 feet B. 3 feet.	10

CLASSIFICATION.

Men obtaining 70 points and upwards qualify to fire with their companies, and compete for prizes ; men failing to obtain 70 points constitute a 3rd class.

RECRUITS JUDGING DISTANCE PRACTICE.

1st Period. Between 100 and 300 yards. Value of Answers, within 5 yards, 3 points. 2 Practices. 8 Answers.

"	"	10	"	2	"
"	"	"	15	"	1

Those men obtaining 14 points and upwards pass into the 2nd Class.

2nd Period { 3rd Class Practice as above. Value of Answers, within 20 yds. 2 pnts. { Those in 3rd Class
 2nd Class, between 305 and 600 yards. " 30 " 1 " making 14 points pass
 into the 2nd Class.

Those men obtaining 10 points and upwards pass into the 1st Class.

3rd Period { 3rd and 2nd Class Practice as above. Value of Answers, within 30 yards, 2 points.
 1st Class, between 605 and 900 yards. " " 40 " 1 "

DETAIL OF PRELIMINARY DRILLS FOR THE DRILLED SOLDIER.

	Aiming Drill.		Position Drill.		Judging Distance Drill.	
	Probable time to be occupied.	Distances to be aimed at.	Time to be occupied.	Number of Drills.	Probable time to be occupied.	Number of Drills.
1st day	One hour each drill.	Three daily; at the discretion of the officer commanding the parade.	Half an hour each	2	One hour each drill.	Known and unknown distances to 300 yards.
2nd day			drill.	2		
3rd day				2		Known and unknown distances at the discretion of the officer commanding the parade.
4th day				2		
Total number of drills ..	..	4	..	8	..	4

DRILLED SOLDIERS' TARGET PRACTICE.

Class.	Distance.	Position.	Targets.	No. of rounds at each distance.
3rd Class.	200 yards 300 yards	Standing Kneeling	Two targets 6 feet × 4 feet. Centre 3 feet, bull's-eye 1 foot.	10
2nd Class.	500 and 600 yards.	Any position.	Three targets 6 feet × 6 feet. Centre 4 feet, bull's-eye 2 feet.	10
1st Class.	700 and 800 yards.	Any position.	Four targets 6 feet × 8 feet, centre 5 feet, bull's-eye 3 feet.	10

CLASSIFICATION.

Under 80 points, 3rd Class; from 80 to under 120, 2nd Class; 180, marksmen.

DRILLED SOLDIERS JUDGING DISTANCE PRACTICE.

Class.	Distance.	No. of Answers in a Class.	Value of Answer.	Points to be obtained to pass into a Higher Class.
3rd Class	Between 200 and 500 yds.	8	Within 15 yards, 2 points; within 30 yards, 1 point.	10
2nd Class	Between 505 and 900 yds.	8	Within 30 yards, 2 points; within 40 yards, 1 point.	10
1st Class	Between 200 and 900 yds.	8	According to the Class the distance is given. Four at least being over 500 yards.	..

CLASSIFICATION.

Under 24 points, 3rd Class; 24 to under 30 points, 2nd Class; 30 points and over, 1st Class.

Century.	Invention.	Exact Date.	In the middle of each century flourished.
14th	Cannon .. ..	..	..
15th	Hand-gun	1414	..
"	Rifles	At end of century.	..
16th	Harquebus	1485. 1509.	..
"	Wheel-lock	1517	..
"	Spiral groove	1520	Tartaglia.
"	Musket	1525	..
"	Pistol	1544	..
17th	Snaphaunce .. ..	..	..
"	Flint-lock	1635	..
"	Rifles used in warfare	..	..
"	Cartridges and boxes	..	..
"	Grain-powder .. ..	..	..
"	Bayonet .. ..	..	..
18th	Socket bayonet	1703	Robins.
"	Iron ramrod	1741	..
19th	Percussion system ..	1807	Whitworth.

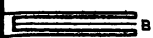
DETAIL OF SUBJECTS OF EXAMINATION.

<p>ORAL.</p> <p>Heard and marked by Capt. Instructors, and Chief Instructor.</p>	<p>{</p> <ol style="list-style-type: none"> 1. Lectures 1 and 2. 2. Lectures 3 and 4. 3. Firing Exercise. 4. Position Drill. 5. Catechising on cleaning Arms. 6. Catechising on Theoretical principles.
<p>PRACTICAL.</p> <p>By Capt. In- structors only.</p>	<p>{</p> <ol style="list-style-type: none"> 7. Throwing out points for Judging Dis- tance. 8. The use of the Stadiometer. 9. The Pocket Sextant and Watkins' Range-finder.
<p>WRITTEN.</p> <p>1st Day.</p>	<p>{</p> <ol style="list-style-type: none"> 1. Duties of Instructors, Aiming Drill, Position Drill, Blank Firing, and Judging Distance Drill. 2. Cleaning Arms and Theoretical prin- ciples. 3. Ranges and Experiments.
<p>2nd Day.</p>	<p>{</p> <ol style="list-style-type: none"> 4. Instruction of Recruit, and Annual course of Trained Soldier. 5. Prizes, and Returns. 6. Target and Judging Distance Practice.
<p>3rd Day. Voluntary,</p>	<p>{</p> <ol style="list-style-type: none"> 7. Theory and Motion of Projectiles. 8. History and Manufacture of Gunpowder. 9. History of Fire-arms.



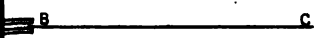
VERTICAL LINE.

FIG. 1.



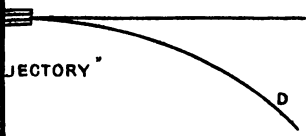
AXIS OF BARREL.

FIG. 2.



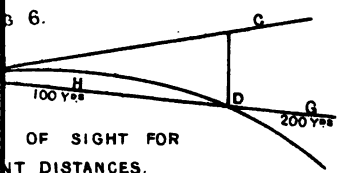
LINE OF FIRE.

FIG. 3.



JECTORY "

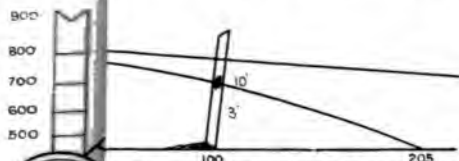
FIG. 4.



OF SIGHT FOR
DISTANCES.



MARTINI HENRY RIFLE



GROUND LINE, LINE OF FIRE, TRAJECTORY
TARGET

Nº 35. MAKE DIAL
BEFORE DETERMINING
OF BACK

TRAJECTORY

Distance	Angle of Fire	Angle of Sight	First
YARDS	FT	IN	TH
100	4	6	TH
200	5	0	TH
300	6	9	TH
400	9	9	TH
500	12	3	TH
600	16	6	TH
700	20	9	TH
800	26	9	TH

TRAJECTORY & UPPER TRAJECTORY
TRAJECTORY

Nº 55. DRAW BARREL SIGHTS
RAYS, LINE OF SIGHT
PUT TARGET ON LINE OF
SIGHT BEFORE DRAWING
DOTTED LINE.



TARGET, SPIRAL, AND TAKE CARE THAT
TOWARDS TRAJECTORY

THIS FIGURE



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